Insider

ESTUARINE HABITATS
ELEMENTARY TEACHING ACTIVITIES SERIES

American Oystercatcher

APALACHICOLA
National Estuarine Research Reserve

ESTUARINE HABITATS
SUPPLEMENTAL TEACHING ACTIVITIES

ACTIVITY BOOK 1

THE PINE FOREST

Supplemental Teaching Activities for Estuarine Habitats

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THE PINE FOREST

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Introduction to the Teacher

The Apalachicola National Estuarine Research Reserve was established in September 1979 as a cooperative effort between Franklin County, the State of Florida and the National Oceanic and Atmospheric Administration. The Reserve is administered by the Florida Department of Natural Resources.

The purpose of the Reserve is to support research relating to the Apalachicola River and Bay estuarine system, disseminate research information, educate the public about estuarine processes, and encourage resource protection.

The purpose of this packet and the other four in the series is to give you, the teacher, supplemental materials and activities for teaching about estuarine system habitats. This packet focuses on the pine forest. The materials may be used to introduce a unit on the pine forest environment or to expand a unit in progress.

The suggested readings listed in the reference section have been researched and selected by classroom teachers. We strongly recommend readings be used to enhance each activity.

Background Information

The Pine Forest

Slash pine dominate pine flatwoods. The slash pine, short leaf, and loblolly pine tend to occur on poorly drained or wet sites. Other trees such as cedars, cabbage palm, sweet bay, wax myrtle, and red maple also exist here.

The vegetation consists of blueberry, saw palmetto, titi, begger lice, running oak, partridge pea, and numerous other plants.

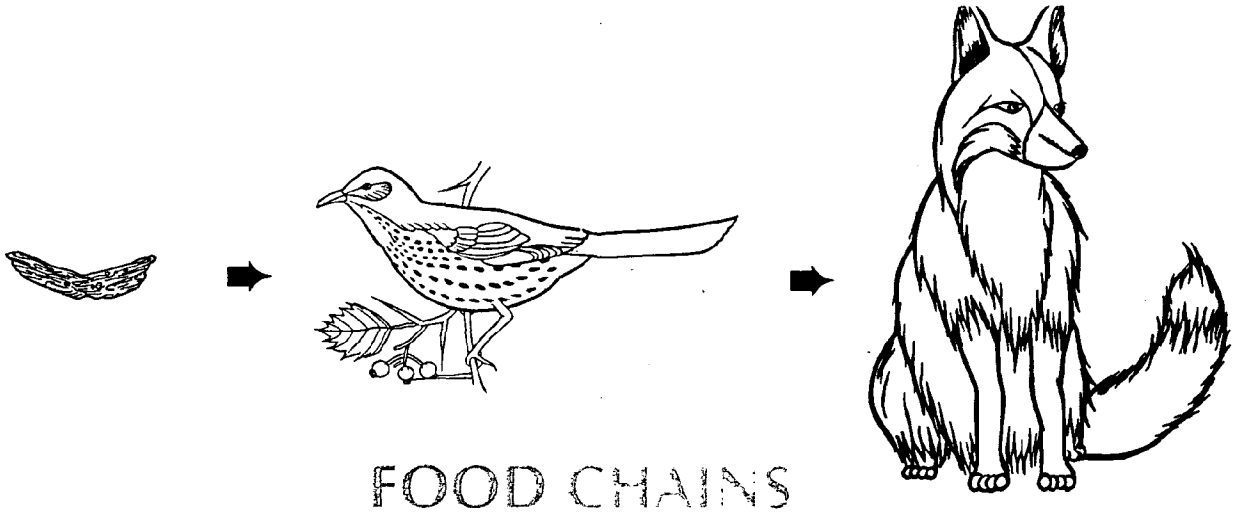
Fire plays an important role in a healthy viable pine forest. Heat from the fire forces open pine cones, which allows the release of seeds. As the seeds wing their way down to the bare soil, a seed bed is established, generating new pine seedlings. The pruning effects of the fire allow sunlight to penetrate the exposed soil, stimulating tender regrowth of plants, flowers, and fruits. This new growth is more nutritious and palatable to wild animals.

Animals such as quail, white tailed deer, squirrel, towhee, woodpecker, box turtle, snake, frog, and rodent benefit by this new food growth.

The results of the fire provide new homes by leaving burned out tree cavities or hollow logs which serve as nests and dens for a variety of wild life.

Coastal run off which drains from the pine forest into the marshes and estuary is important to the ecosystem. This run off moves detritus and nutrients down river into the estuary system. Many plants and animals depend on detritus for food.

The habitats surrounding the pine forest are dependant upon how hardy the pine forests are, so how we deal with the pine forest has a timely effect on our wetlands.



FOOD CHAINS

Pine Seed ➡	Brown Thrasher ➡	Red Fox	
Mosquito Larvae ➡	Bream ➡	Water Moccasin ➡	King Snake
Woodpecker Egg ➡	Squirrel ➡	Hawk	
Moth ➡	Tree Frog ➡	Pine Snake ➡	Barred Owl

Common Plants and Animals of the Pine Forest

ANIMALS

Amphibian
Tree frog

Birds
Turkey Vulture
Red-shouldered hawk
Barred owl
Brown thrasher
Red-cockaded woodpecker
Pine warbler

Reptiles
Gulf coast box turtle
King snake
Pine snake
Diamondback rattlesnake

Mammals
Cotton rat
Cottontail rabbit
Spottedskunk
Red fox
Bob cat
Black bear

Insects
Bumble bee
Mosquito
Tick
Brown spider
Moth

Fish
Bream

PLANTS

Slash pine
Begger lice
Titi
Poke Weed
Grape vine
Cabbage palm
Partridge pea
Blackberry
Short leaf pine
Saw palmetto

Interrelationship Between Man and Trees

Read aloud the book *The Giving Tree* by Shel Silverstein*. After reading have the class list all the things trees give mankind and all the ways we can help trees.

Trees give:

1. Habitat for animals
2. Oxygen
3. Stability to soil
4. Erosion control
5. Beauty
6. Wood
7. Shade
8. Blossoms
9. Fruit and nuts
10. Turpentine
11. Boxes and baby diapers (fibers)

We can give to trees:

Protection from uncontrolled fire
Protection from over cutting
Planned replanting
Rotating planting
Allow hedges on corridors of understories for animals to move through
Fertilizer

* Available on loan from The Apalachicola National Estuarine Research Reserve library.

Leaf Hunt Relay

Materials needed: A yard or area on school grounds where it is full of leaves.

Activity:

Divide your class into teams approximately 5 to 6 per team. Then ask players to collect leaves from different kinds of trees. Avoid stripping live leaves if possible; use leaves which have fallen to the ground. The students can compare the leaves on the ground with the ones in the tree to see if they are the same.

Ask students to collect as many leaves fallen from each tree as there are teams. For each team, make a leaf pile consisting of one leaf from each tree, and place this pile at a set distance in front of the team. The leader calls the name of a tree (or holds up a leaf) then says "Go". The first student in each team runs to the pile of leaves, finds the leaf from the tree named (or shown), and holds it up. A point is awarded for each leaf correctly identified.

The leaves are returned to the piles, and the players go to the end of the line so that the next player from each team can test his or her knowledge.

Matching Animal Tracks to the Animal

This is a good activity for practicing categorization skills.

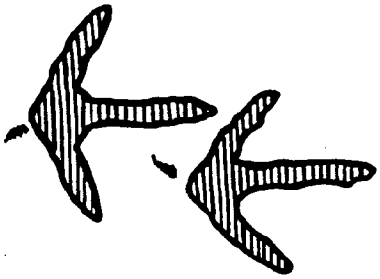
Make copies of the five animal tracks pictured below for each student. Have pictures of the five animals that have made the tracks plus a deer picture available to show the class.

You already know that little animals make little tracks and big animals make big tracks. But some animals leave big tracks in relation to their smaller body size. Were the tracks make by a mouse or a hippopotamus?

Number 1, is a rat track and number 2 is a squirrel track. The skunk track, number 5, is the same size as track number 4 made by the raccoon, an animal that is taller and larger than a skunk. The wild turkey track number 3 is almost as large as that of a deer yet the bird is a lot smaller in size than a deer.

1. 

2. 

3. 

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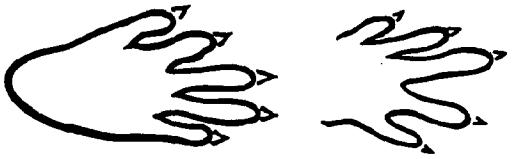
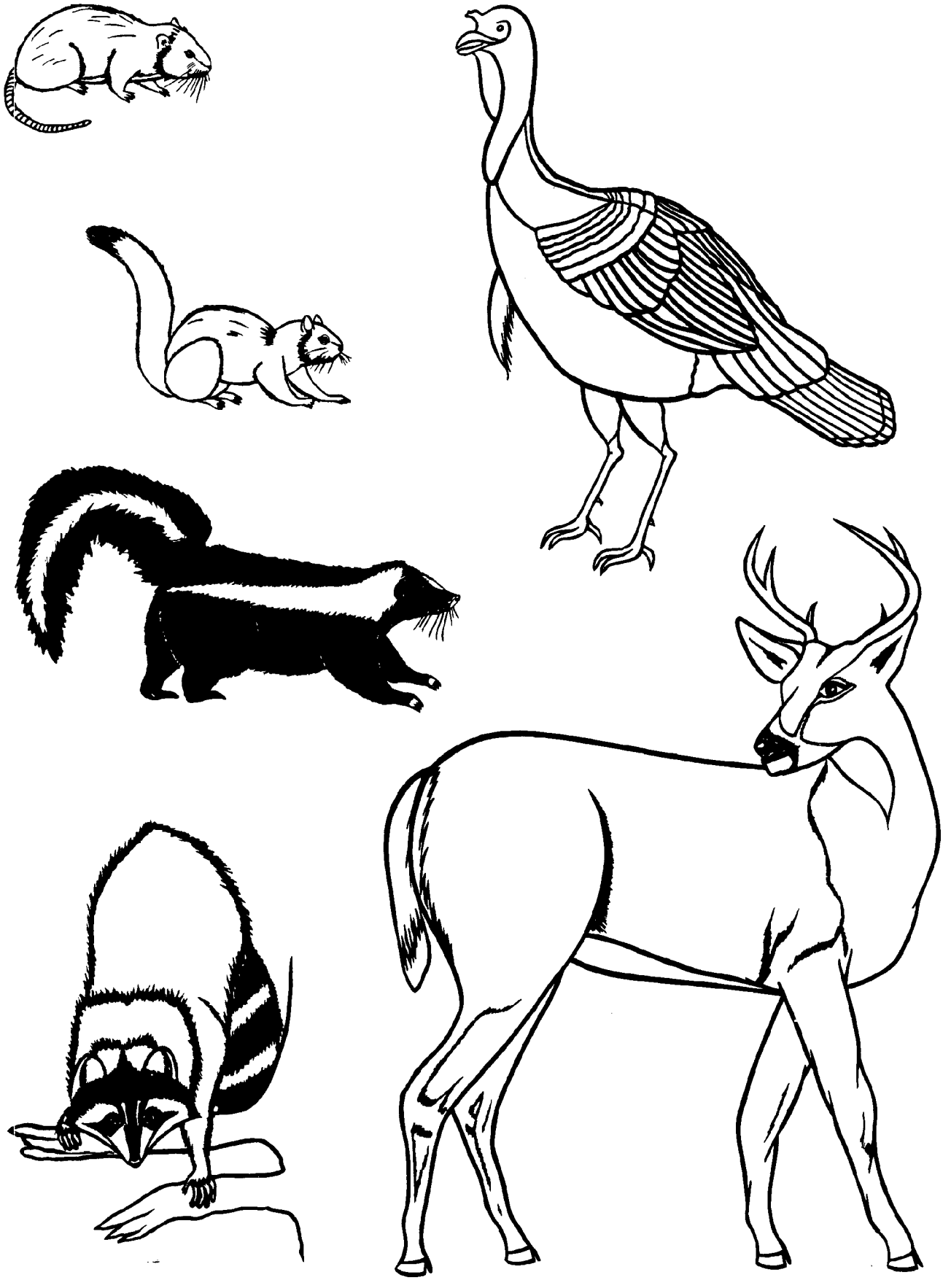
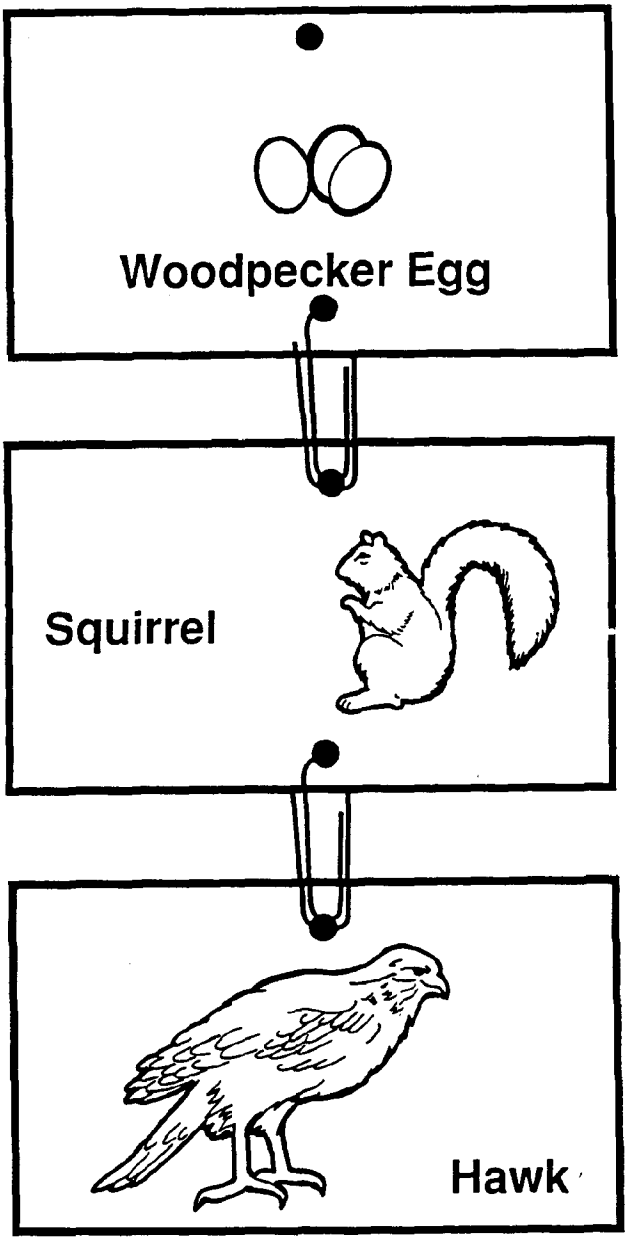
5. 



Food Chain Mobile

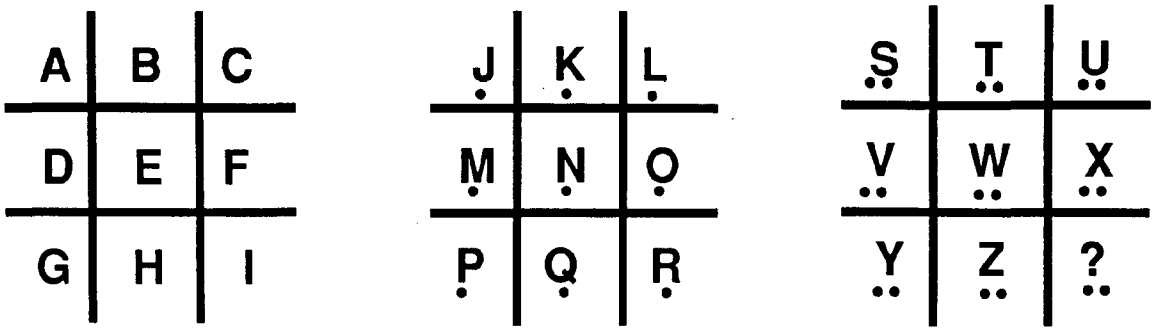
Materials needed: Index cards, paper clips, pencil, crayons or felt tip pens and paste.

Procedure: Using the Pine Forest Food Chain or creating your own food chain, draw a picture or paste a picture of each of the critters in the food chain on separate index cards. Then link them together with paper clips completing a food chain mobile. Hang them up in your room.



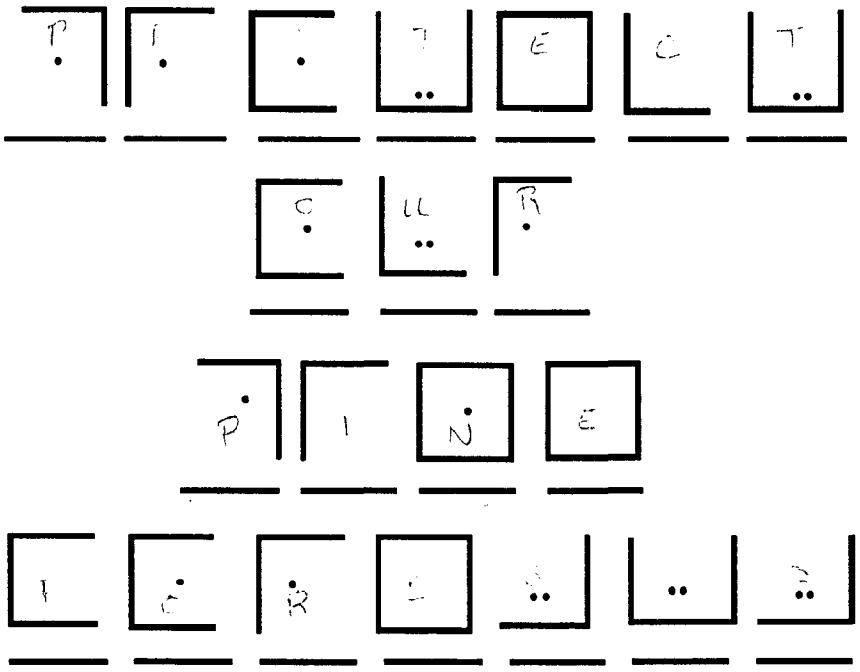
TIC-TAC-CODE

By sorting the alphabet into three tic-tac-toe frames you can shape the key to another puzzler. Here it is :



In a coded message, each letter A through I is shown by the lines around the letter. For example, A is ⌊ , E is □ , H is ⊓ , and so on. Lines and dots stand for the rest of the alphabet letters, form J, ⌊· , to Z ⊓ .

TRY THE KEY: CRACK THE CODE



ANSWER: PROTECT OUR FORESTS

BREAK THE CODE

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
9	20	8	3	17	2	18	21	16	1	15	22	24	14	4	13	5	19	6	25	12	11	7	26	23	10

Use the key above to break the coded messages below.

The dots separate the numbers in each word. Two dots separate words from each other. Three dots end a sentence.

1. **6.22.9.6.21..13.16.14.17**

2. **25.19.17.17..2.19.4.18**

3. **3.16.9.24.4.14.3.20.9.8.15..19.9.25.25.22.17.6.14.9.15.17**

4. **6.9.7..13.9.22.24.17.25.25.4**

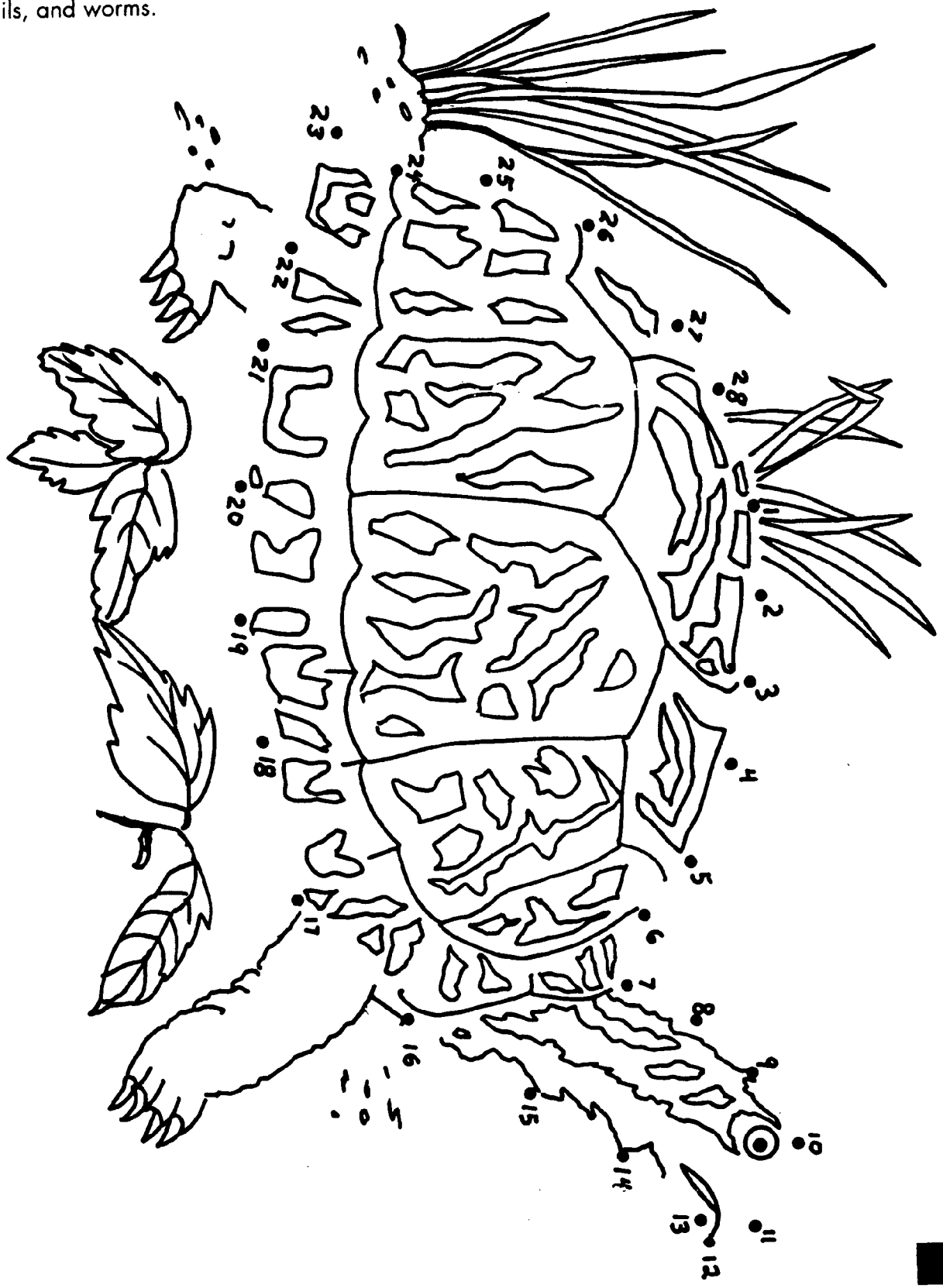
5. **20.22.9.8.15..20.17.9.19.6..**
   22.16.11.17..16.14..13.16.14.17
   2.4.19.17.6.25.6...

ANSWERS:

1. SLASH PINE
2. TREE FROG
3. DIAMONDBACK RATTLESNAKE
4. SAW PALMETTO
5. BLACK BEARS LIVE IN PINE FORESTS

Eastern Box Turtle Dot-To-Dot

The box turtle is a land animal. They prefer moist open woods or swamps. They eat blackberries, insects, snails, and worms.



How Many Bears Can Live In This Forest?

(From **Project WILD**)

Materials: Five colors of construction paper (two or three sheets of each color) or equal amounts of light poster board, one black felt tip pen, envelopes or small brown paper bags (one per student), pencils, and one blindfold.

Procedure:

1. Cut the paper or poster board into 2" x 2" or 2"x3" pieces. For a classroom of 30 students, make 30 cards of each color as follows:

   Orange - (nuts) mark five pieces N-20, mark 25 pieces N-10

   Blue - (berries) mark five pieces B-20, mark 25 pieces B-10

   Yellow - (insects) mark five pieces 1-12, mark 25 pieces 1-6

   Red - (meat) mark five pieces M-8, mark 25 pieces M-4

   Green (plants) mark five pieces P-20, mark 25 pieces P-10

The following estimates of total pounds of food for one bear in ten days are used for this activity:

Nuts - 20 pounds = 25%
Berries - 20 pounds = 25%
Insects - 12 pounds = 15%
Meat - 8 pounds = 10%
Plants - 20 pounds = 25%
80 pounds = 100% in ten days

2. In a fairly large open area (50'x50') scatter the colored pieces of paper.

3. Have each student write his or her name on an envelope or paper bag. This will represent the student's "den site" and should be left on the ground by their feet (anchored by a rock) at the starting line on the perimeter of the field area.

4. Give the following instruction: "You are now all black bears. All bears are not alike, just as you and I are not exactly alike. Among you is a young male bear who fought with a large male bear over territorial rights, he was hurt. He had a broken leg. (Assign one student as the crippled bear. He must hunt by hopping on one leg.) Another bear is a young female who was blinded. (She must hunt blindfolded. The third special bear is a mother bear with two small cubs. She must gather twice as much food. (Assign one student as the mother bear.)

5. Do not tell the students what the colors, initials and numbers on the pieces of paper represent. Tell them only that the pieces of paper represent various kinds of bear food.

6. Students must walk into the "forest". Bears do not run down their food, they gather it. When students find a colored square, they should pick it up (one at a time) and return it to their "den" before picking up another colored square.

7. When all the colored squares have been gathered, the food gathering is over. Have students pickup the den bags containing food they gathered and return to class.

8. Explain what the colors and numbers represent. Ask each student to add up the total number of pounds of food gathered. Each should write the total weight on the outside of his envelope or bag.

9. Using a chalkboard, list "blind", "crippled", and "mother". Ask each respective bear how much food they got and record the information. Tell the students each bear needs 80 pounds to survive.

Questions you can ask the class:

1. Which bears survived?

2. Is there enough to feed all the bears? If not, how many bears can live in this area? What would happen to the extra bears? Would they all starve?

3. How many pounds did the blind bear collect? Will she survive?

4. What about the mother bear? Did she get twice the amount needed to survive? What will happen to her cubs? Will she feed cubs first or herself? Why? What would happen to her if she fed the cubs? What if she ate first? If the cubs die, can she have more cubs in the future? (The mother bear will eat first. The mother must survive, she is the hope for a continued bear population.)

Stand-Up 3-D Board

Materials:

Corrugated cardboard (about 14"x14", thin cardboard pieces (10) per person, magic markers, knife (to make slits in base), crayons, and scissors.

One side of your 3-D Board will show some elements in a healthy pine forest.

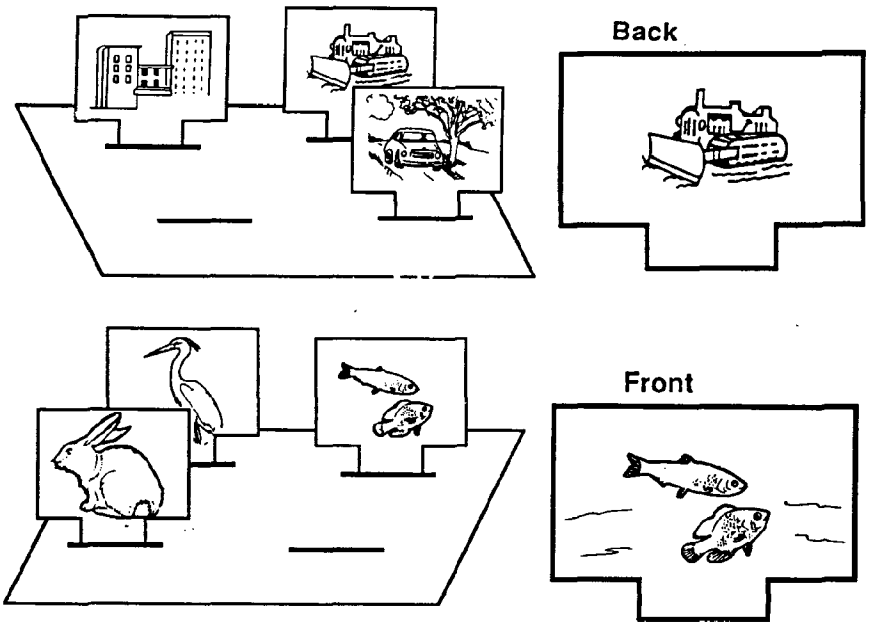
Turn the board around and see the man-made disturbance which upset the pine forest.

Procedure:

1. Explain to students that they are display designers of a museum with the task of making a 3-dimensional model of a pine forest. When it is looked at one way, the model is to show a healthy pine forest, and when turned around, it is to show how man can upset the balance of the system.
2. Demonstrate how to make the board using the base with slits and one of the precut thin cardboard pieces. Draw a member of a food chain, such as a fish, on one side and a man-made disturbance, such as a bulldozer, on the other. Put the tabs of the piece into the slits on the base. Turn the board so participants can view both sides.
3. Give each person a baseboard and some thin cardboard pieces to design a pine forest board. When all the cardboard pieces are in place, the baseboard can be decorated. It may be necessary for the teachers to cut the slits in the baseboards.
4. Discuss the participants' boards and have them explain the subjects chosen.

Questions

1. Are all of man's interferences in the pine forest harmful?
2. Do natural forces, such as, drought, hurricanes, and fire also upset the equilibrium in a pine forest?
3. How would litter and not fires effect a pine forest?



SONGS

"Communities in Nature"

Tune: This Land Is Your Land

This land is your land.
This land is my land.
From the piney forest
To the swampy regions.
From the fresh water marshes
To the big salt marshes.
This land was made for you and me.

"Song of the Piney Woods"

Tune: While Strolling Through The Park One Day

While searching through the moonless night.
I'll be watching with my keen clear sight.
I'll take'em by surprise.
You'll never hear their cries.
I'll swoop and carry them away.

Slithering through the pines one day.
I'll use venom to catch my prey.
I'll stun'em with a bite.
They won't put up a fight.
Then I'll nap in the pines all day.

We're trapping in the pines today.
Spinning webs our special way.
Catching bugs in our trap.
Putting them in a wrap.
We snare our prey that way.

Have students identify the animals depicted by each verse.

Reference Tape

"Songs From the Water World" by Jill Jarboe

1. "Too Bugged to Boogie"
2. "Waterlily"
3. "The Wetlands Waltz"

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THE HARDWOOD SWAMP

ESTUARINE HABITATS
SUPPLEMENTAL TEACHING ACTIVITIES

ACTIVITY BOOK II

THE HARDWOOD SWAMP

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The purpose of this packet and the other four in the series is to give you, the teacher, supplemental materials and activities for teaching about estuarine system habitats. This packet focuses on the hardwood swamp. The materials may be used to introduce a unit on the hardwood swamp environment or to expand a unit in progress.

The suggested readings listed in the reference section have been researched and selected by classroom teachers. We strongly recommend readings be used to enhance each activity.

Background Information

The Hardwood Swamp

Swamps develop in still water areas, around lake margins, and in parts of flood plains. A swamp is a type of wetland which is often waterlogged in winter and early spring but may be quite dry in the summer.

The swamp is identified by an abundance of woody plants, including such trees as water oak, tupelo, blackgum, white cedar, and cypress. Other typical plants include dahoonholly, loblolly bay, pond apple, fetterbush, Virginia willow, chain fern, poison ivy, spanish moss, orchids, and titi.

Mosquitoes and cottonmouth moccasins are often concealed by the green layer of duckweed floating on the water. Alligators, bullfrogs, and newts are found in permanent bodies of water, while toads and salamanders utilize temporary water bodies. Fish such as mosquitofish, killifish, and small minnows along with many insects are found in various stages of development in the swamp waters.

Swamps also provide nesting and feeding habitats for ospreys, eagles, and wading birds. The wood ducks, swallow-tailed kites, and snapping turtles may also be seen by the perceptive observer.

An abundant variety of plant and wildlife breed, feed, grow, and decompose in this swampy habitat, producing food, oxygen, water recreation, and enjoyment for you and me.

FOOD CHAINS

Mosquito larvae ➡	Mosquitofish ➡	Night heron ➡	American alligator
Duck weed ➡	Wood duck ➡	Man	
Algae ➡	Minnow ➡	Bream ➡	Eagle
Grass ➡	Marsh rabbit ➡	Black bear	

Common Plants and Animals of a Hardwood Swamp

ANIMALS

Insects
Honey bee
Cricket
Butterfly

Amphibians
Bullfrog
Newt
Toad
Salamander

Reptiles
American alligator
Cottonmouth moccasin
Snapping turtle
Mud turtle

Fish
Mosquitofish
Killifish
Bass

Birds
Swallow-tailed kite
Wood duck
Redwing blackbird
Night heron

Mammals
Nutria
Beaver
Otter

Crustacean
Crayfish

PLANTS

Duckweed
Water oak
Swamp tupelo
Poison ivy
Blackgum
Cypress
Fern
Purple fern
Hickory

Poetry "Wildlife Cinquains"

Materials needed: paper, pencils and crayons.

Directions: Have each student choose one animal from the swamp. On story paper, have each student write a sentence describing a fact about the animal. Ask students to illustrate their facts and color the pictures with crayons. Display around the room.

Have students write swamp cinquains. A cinquain is a five-line poem. Each line has a specific number of syllables as follows:

Line 1 = 2 syllables
Line 2 = 4 syllables
Line 3 = 6 syllables
Line 4 = 8 syllables
Line 5 = 2 syllables

It is easy for children to write and it doesn't have to rhyme. Ask each student to choose one animal that lives in the swamp. Then instruct students to write their cinquains step-by-step:

Line one: Write the name of the animal in two syllables.
Line two: Describe the animal in four syllables.
Line three: Describe something the animal does in six syllables.
Line four: Describe something you know about the animal in 8 syllables.
Line five: Rewrite the name of the animal in two syllables.

Examples:

Otter
furry, floater
bobbing, swimming, diving
The swamp's your home-today
Otter

Osprey
Fishing eagle
Flying, diving, hunting
With graceful strength he finds his meal
Osprey

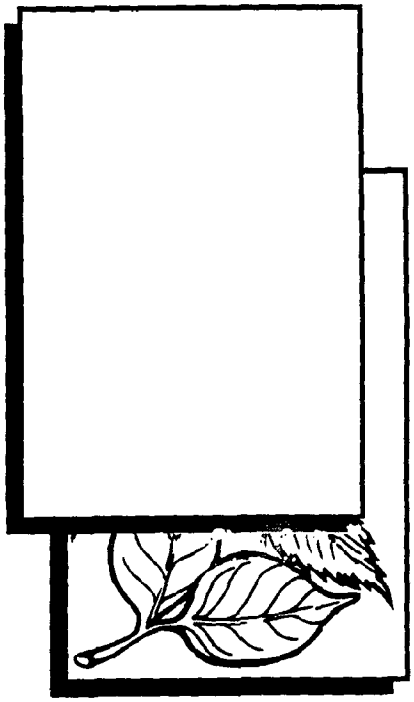
Leaf Rubbings

Materials needed: Tree leaves, typewriter paper or other lightweight paper, and crayons.

Directions: Place the leaves onto a sheet of the paper. The raised sides of the leaves should face you. Place another sheet of paper over the leaves, hold them in place with your hand so they don't shift. Remove the protective paper covering from an old crayon. Rub over the surface of the top paper with the side of the crayon. The veins and shape of the leaf under your rubbing will appear. Try using different colors of crayon for the different leaves, or for different parts of a single leaf.

A

B



C

Swamp Outing" Hidden Pictures

Directions: In the picture below find the minnows, alligator, redwing blackbird, wood duck, toad, mud turtle, cottonmouth moccasin, and otter.

Filtering Out Water Pollution

(From **The Whole Cosmos Catalog of Science Activities**)

One type of water pollution is caused by solids that are found in water supplies. By filtering water you can remove the solids. Water that has been filtered may not be safe to drink because some pollutants, such as bacteria and chemicals, cannot be filtered out.

Materials needed: Small jars with tops, one large jar, paper towels, and a funnel.

Making Filters:

1. Take a paper towel and fold it in half lengthwise.

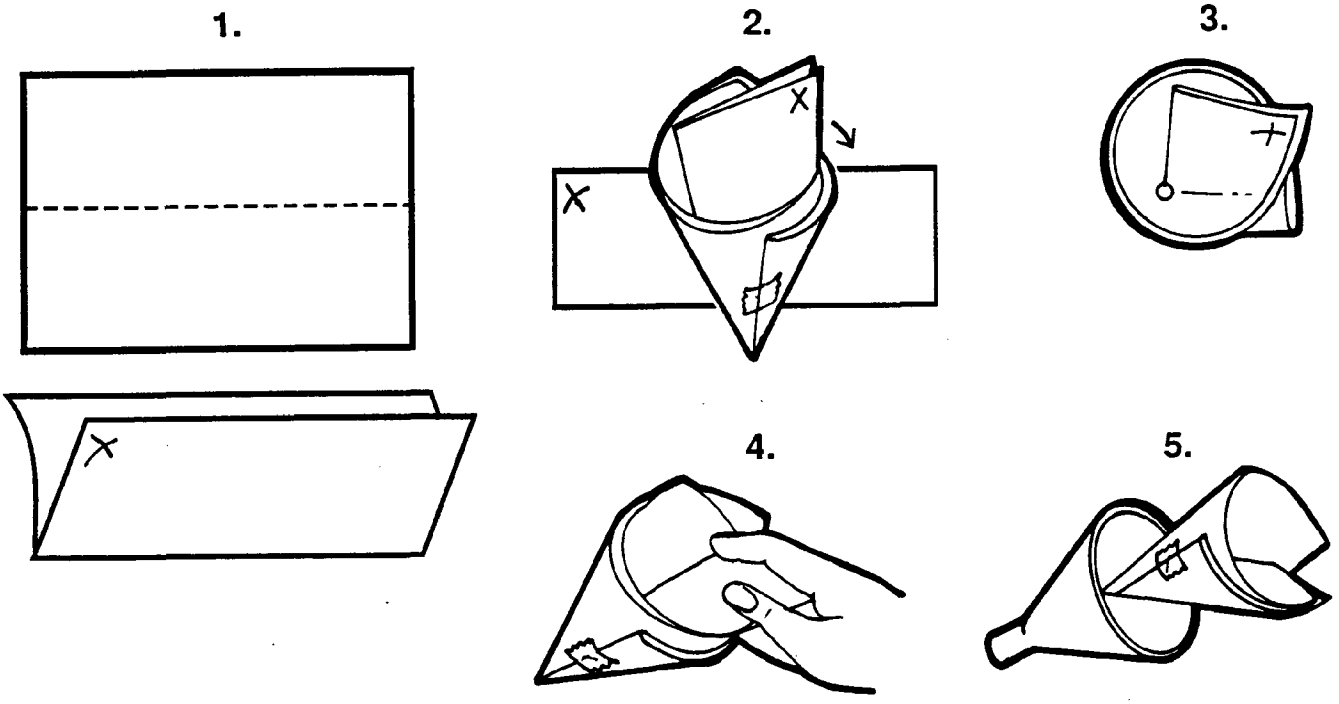
2. Put an X in the upper-left-hand corner. Now roll the folded towel into a cone so that the X is inside the cone. Tape the outside of the cone so it doesn't open.

3. Look down the cone and notice the hole in the bottom. This hole will let the solids go through, so we need to cover it.

4. Reach into the top of the cone and put your finger in the fold by the X. Separate the fold and push it to the side. The X should not be visible and the hole should have disappeared.

5. You now have a filter. Make at least ten of them.

Since the filter is only paper, it will not be strong enough to hold very much water. To solve this, place the filter in a funnel.



Filtering Water:

Use your small jars to collect samples of water from streams, ponds, or lakes. Also collect a small jar of tap water. Mark the jars so that you know where the water came from.

1. Place the funnel containing one of your filters in the neck of the large jar. Pour a jar full of your collected water through the funnel and filter.

2. Remove the paper towel filter cone and open it up. On it, write the name of the place where you collected the water sample.

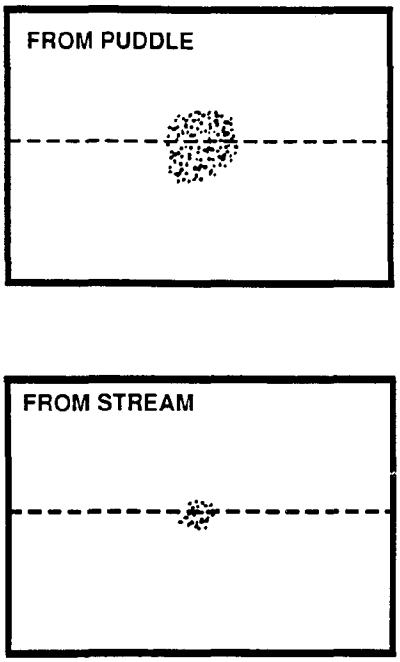
3. Repeat Step 2, using the same amount of water from each sample with a new filter cone. Be sure to label each used cone.

4. Compare the amount of material filtered out, the color of the filtered materials, and the kinds of particles that were caught by your filters. Which sample of water had the most solids in it?

Water that has been filtered usually looks cleaner than it did before it was filtered. Filtering is one of the first steps in making water safe to drink, but filtering water is not enough. Even though filtering makes water clearer, harmful bacteria and poisonous chemicals may still be in the water, so don't drink it.

1.

2.



Habitat Lap Sit

(Adapted from **Project WILD**)

Procedure:

1. Ask the students to number off from "one" to "four". The "ones", sit or stand together, "two's" together, etc.

2. Clear a space in the center of the room or use a clear grassy area.

3. Assign each group a concept as follows: "ones" = food, "two's"= water, "three's" = shelter, "four's" = space.

4. Now, its time to form a circle. (This is done by building the circle in chains of food, water, shelter, and space. A student from each of the four groups walks toward the cleared area. Then four more- one for each group, until all students are in the circle.

5. All students should be standing shoulder to shoulder facing center of circle.

6. Ask students to turn toward their right and take one step toward the center of the circle. They should stand close together, with each student looking at the back of the head of the student in front of them.

7. Everyone place their hands on the waist of the person in front of them. At the count of three, students set down on the knees of the person behind then, You say, "Food, water, shelter, and space - in the proper arrangement are what is needed to have a good habitat."

8. Now say "It is a drought year". Ask the student who represents water to get out of the circle and watch the circle collapse, or suffer from disruption arrangement. Ask food to remove themselves from the circle,etc., until the circle collapses.

Color the Cottonmouth

This poisonous pit viper is often referred to as a cottonmouth, due to the white color inside its open mouth. It is found in the swamp feeding on fish and frogs. Many snakes lay eggs, one of the characteristics they share with birds. The female cottonmouth gives birth to live young.

Swamp Riddles

1. I am big and have a hard covering. I have a big mouth with lots of teeth. I am the largest reptile in the swamp. Who am I?

2. Cross out the letters (in order) that spell the name of the still water areas, around lake margins, and in parts of flood plains.

   S O R W L A Q I M Z V P

3. What tree would typically be found in the swamp.

   ___Coconut palm ___Tupelo ___Live oak

4. What word below would correctly complete this sentence? Beavers build their homes in water out of _____.

   A. Bricks B. Concrete C. Trees

5. I am a mosquitofish. I eat mosquito larvae and live in the swamp. I'd dry up and die if I didn't have _____ to swim in.

ANSWERS: 1. alligator, 2. swamp, 3. tupelo, 4. trees, 5. water

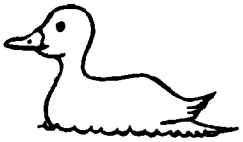
Swamp Rebus

1.   _____

2.   _____

3.   _____

4.    _____

5.   _____

6.    _____

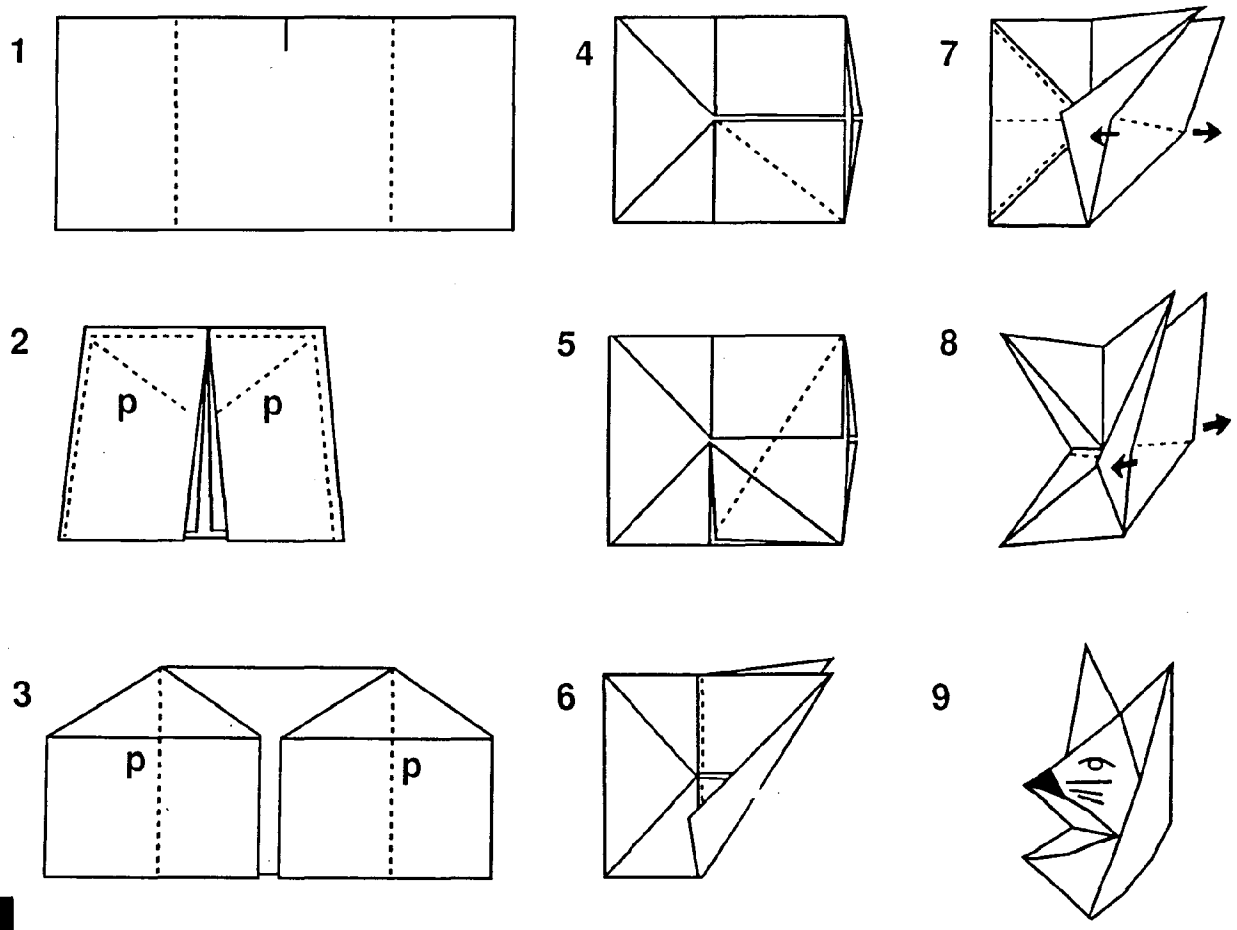
7.   _____

1. Blackgum
2. Bullfrog
3. Mosquitofish
4. Swallow-tailed kite
5. Wood duck
6. Night heron
7. Beaver

Fox Mask

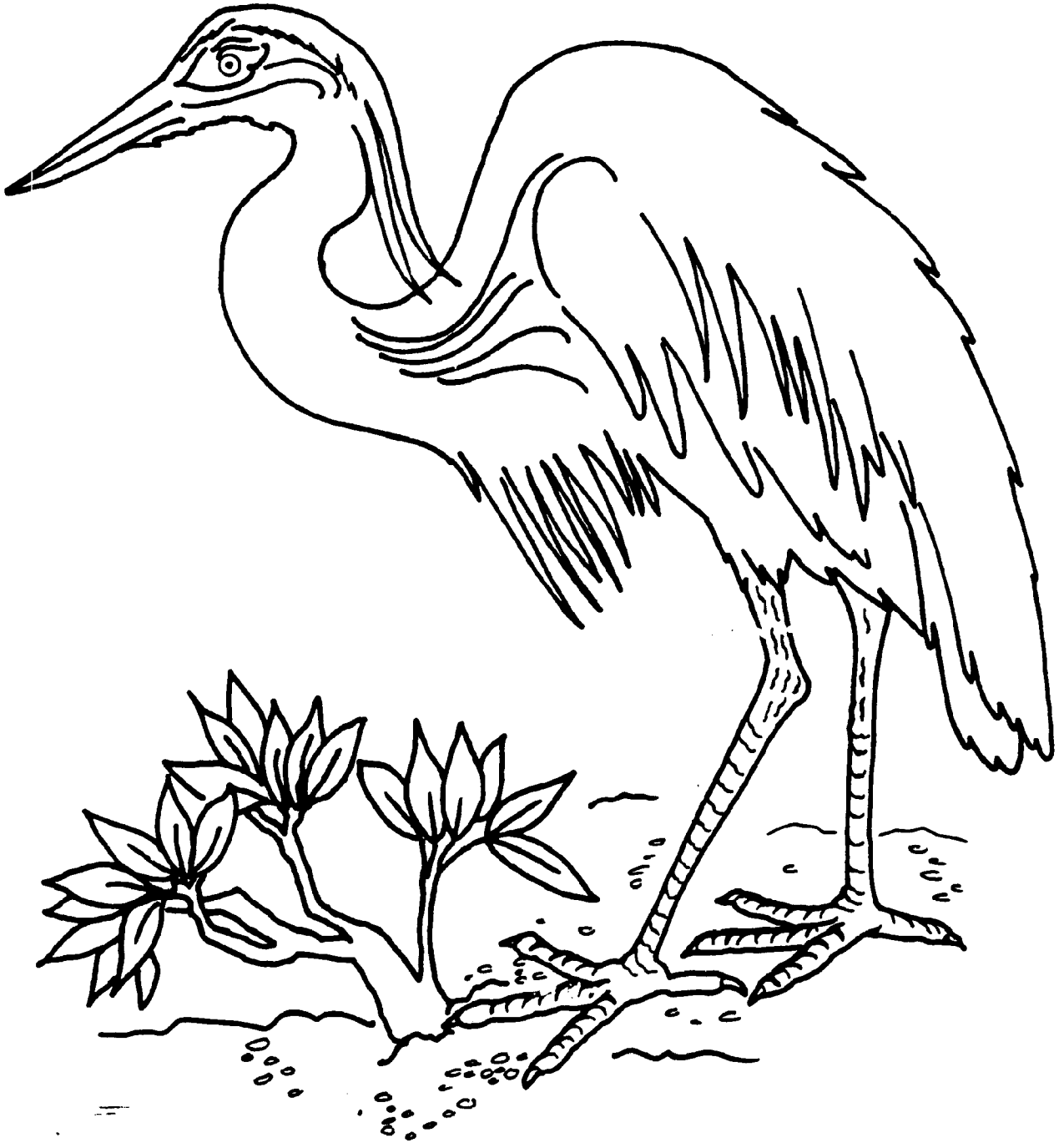
Use a square of white paper.

1. Book fold the paper in half. Fold the outer edges to the center line.
2. Peak and valley fold on the dotted lines.
3. Open both sides to the position shown in the chart, and peak fold on the dotted lines.
4. Turn the model into the illustrated position and valley fold the front flap in the dotted line. Turn the model over and repeat.
5. Valley fold the top flap on the dotted line. Turn the model over, and repeat the fold.
6. Valley fold the top flap on the dotted line. Turn the model over and repeat.
7. Peak fold on the dotted lines, and pull the sides of the mask outward as illustrated.
8. Pull gently until the mask has assumed the proper shape.
9. If you hold the mask with your finger tips as shown, you can make it move its jaws as if it were barking.



Great Blue Heron Color Page

A large, grey-blue, black stripe extends above this heron's eye. This big bird wades in the water's edge in search of small fish and crustaceans.



There Was An Old Lady (Swamp Version)

There was an old lady who swallowed a fly
I don't know why she swallowed a fly,
Perhaps she'll die.

There was an old lady who swallowed a spider.
That wriggled and tickled and jiggled inside her.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
Perhaps she'll die.

There was an old lady who swallowed a fish.
Imagine this, she swallowed a fish.
She swallowed the fish to catch the spider.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
Perhaps she'll die.

There was an old lady who swallowed a snake.
It made her shake to swallow the snake.
She swallowed the snake to catch the fish.
She swallowed the fish to catch the spider.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
Perhaps she'll die.

There was and old lady who swallowed a bird.
How absurd to swallow a bird!
She swallowed the bird to catch the snake.
She swallowed the snake to catch the fish.
She swallowed the fish to catch the spider.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
Perhaps she'll die.

There was an old lady who swallowed a fox.
It rolled her soxs to swallow a fox.
She swallowed the fox to catch the bird.
She swallowed the bird to catch the snake.
She swallowed the snake to catch the fish.
She swallowed the fish to catch the spider.
She swallowed the spider to catch the fly.
I don't know why she swallowed the fly.
Perhaps she'll die.

There was and old lady who swallowed a gator.
She died later.

Alligator

Tune: Rubber Duckie (From Sesame Street)

Alligator, you're the one
You make nature lots of fun.
Once endangered, protection has brought you back.

Alligator now the king.
With powerful jaws you eat things.
Snakes and turtles and many aquatic prey.

OPTIONAL

Sneaking up on them - till you catch them.
Then Snap! Snap!
Oh-Oh-Oh-There is no escape
From your powerful death trap.
Snap-a-snap, snap, snap!

Alligator, so proud to say.
That you are here to stay.
Alligator protection has brought you back!

FINALE

Alligator protection has helped you
Alligator protection has brought you back!

Reference Tape

"Songs From the Water World", by Jill Jarboe (Available on loan from the Apalachicola National Estuarine Research Reserve resource library.)

1. "Amphibians Lead Two Lives"
2. "Gator"

References

1. "Waterlogged Wealth," Edward Maltby
   Publication of the International Institute of Environment and Development.

2. "Our Nations Wetlands", Elinor L. Horwitz
   Publication by U.S. Government Printing Office, Washington, DC.

3. "Resource Inventory of Apalachicola River and Bay Drain Basin", Florida Game and Fresh Water Fish Commission,Lee Edmiston and Holly A Tuck.

4. *Project WILD* Western Reg. Environmental Education Council, 1983.

5. *The World of Origami,* Isao Hands, Japan Publishing Trading Co.

6. *The Whole Cosmos Catalog of Science Activities,* by Joe Abruscato and Jack Hassard, 1977.

Suggested Readings

1. Mystery Marsh, Vincent Marteko, Ranger Rick, Aug.-Sept. 1976.

2. Life in a Brook, Lawerance Previgle, Ranger Rick.

3. Grow Gator Grow, James R. Newton, Ranger Rick, Noe. 1988.

4. The Swamp, Daniel Jack Chase, Audubon, March 1988.

5. Swamp Ecology - Okefenokee Swamp, Cortesi, Wendy W.

6. Explore Spooky Swamp, Wendy W. Cortesi, Books for young explores: National Geographic Society.

THE ESTUARY

ESTUARINE HABITATS
SUPPLEMENTAL TEACHING ACTIVITIES

ACTIVITY BOOK III

THE ESTUARY

TABLE OF CONTENTS

Introduction to the Teacher

The Apalachicola National Estuarine Research Reserve was established in September 1979 as a cooperative effort between Franklin County, the State of Florida and the National Oceanic and Atmospheric Administration. The Reserve is administered by the Florida Department of Natural Resources.

The purpose of the Reserve is to support research relating to the Apalachicola River and Bay estuarine system, disseminate research information, educate the public about estuarine processes, and encourage resource protection.

The purpose of this packet and the other four in the series is to give you, the teacher, supplemental materials and activities for teaching about estuarine system habitats. This packet focuses on the estuary. The materials may be used to introduce a unit on the estuarine environment or to expand a unit in progress.

The suggested readings listed in the reference section have been researched and selected by classroom teachers. We strongly recommend readings be used to enhance each activity.

BACKGROUND INFORMATION

The Estuary

Estuaries are semi-enclosed bodies of water. Fresh water flows down the river and mixes with salt water which moves in and out of the estuary with the tide. Estuaries, where rivers meet the sea, support large commercial fisheries. They act as spawning and nursery grounds for most forms of seafood. When it rains the nutrients and pollutants which run off the land, travel down the river to the estuary which serves as a buffer zone capturing the nutrients and slowly releasing them to the open sea. These nutrients are essential to the whole chain of life in the estuary because all plants, both rooted and microscopic plants, (phytoplankton) require these nutrients.

Sunlight is an important factor in an estuary. Sunlight must be able to penetrate the water to a depth which will allow rooted plants and phytoplankton to grow.

In the grass flats, rooted plants such as shoal grass and turtle grass can be found along with colonial animals that might look like plants. Plant - like bryozoans and spongy looking tunicates are actually animals. Nutrients, organic detritus, and organisms move readily in and out of this community and the intertidal flat community with each tidal cycle.

At first glance mud flats seem to lack vegetation. However, closer examination would reveal a number of small microscopic producers. The red, blue-green, and green algae and diatoms are found on the surface of the sediments. Under the mud, lugworms with their round air hole and waste pile may be found along with trails left by a variety of clams and mussels. On top of the mud flats, horseshoe crabs plow the surface, oysters attach to hard stationary objects and hermit crabs occupy empty shells. These primary consumers provide an energy source for bottomfeeders like crabs, pistol shrimp, pig fish, spots and drum. They support a large population of wading and shore birds.

The word estuary comes from the Latin word "aestus", which means tides.

The abundant plant life in an estuary attracts an endless variety of animals because of the food and shelter available. The amount of plant material produced in an estuary far exceeds that of even our cultivated corn fields. We are now experimenting with Apalachicola oyster aquaculture (oyster farming). There is a project going on in the Apalachicola estuary call the Oyster Demonstration Project. A flexible belt system of PVC pipes, rope and nursery bags is used. One million oyster seeds per acre have been planted. These artificial oyster acre sites will produce 2,000 oysters per acre compared to 400-600 oysters per acre on a natural one acre oyster bar.

The estuary system is an abundantly rich resource from which wildlife and man can draw from and benefit by if we are wise caretakers of and grow from the wealth of knowledge and secrets that are still held in store for us and future generations.

FOOD CHAINS

Detritus ➡	Oysters ➡	Crown Conch		
Detritus ➡	Lugworm ➡	Crab ➡	Fish ➡	Man
Phytoplankton ➡	Shrimp ➡	Flounder ➡	Man	
Algae ➡	Clam ➡	Sea gull		

Common Plants and Animals of the Estuary

ANIMALS

Colonial
Bryozoans
Tunicates

Invertebrates
Lugworm
Spotted sea hare
Shark eye moon snail
Florida sea cucumber
Purple sea urchin

Shellfish
Hermit crab
Crown conch
Horseshoe crab
Stone crab
Common razor clam
Oyster
Brown shrimp

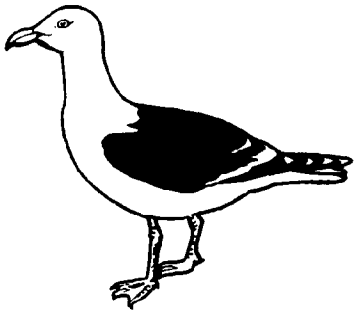
Fish
Flounder
Mullet
Sheephead minnow
Stingray
Skate
Shark

Birds
Little blue heron
Brown pelican
Common loon
Royal tern
Laughing gull
Double-crested cormorant

Mammals
Raccoon
Porpoise
Manatee

PLANTS

Shoal grass
Manatee grass
Algae: red, green, and blue-green
Diatoms
Phytoplankton



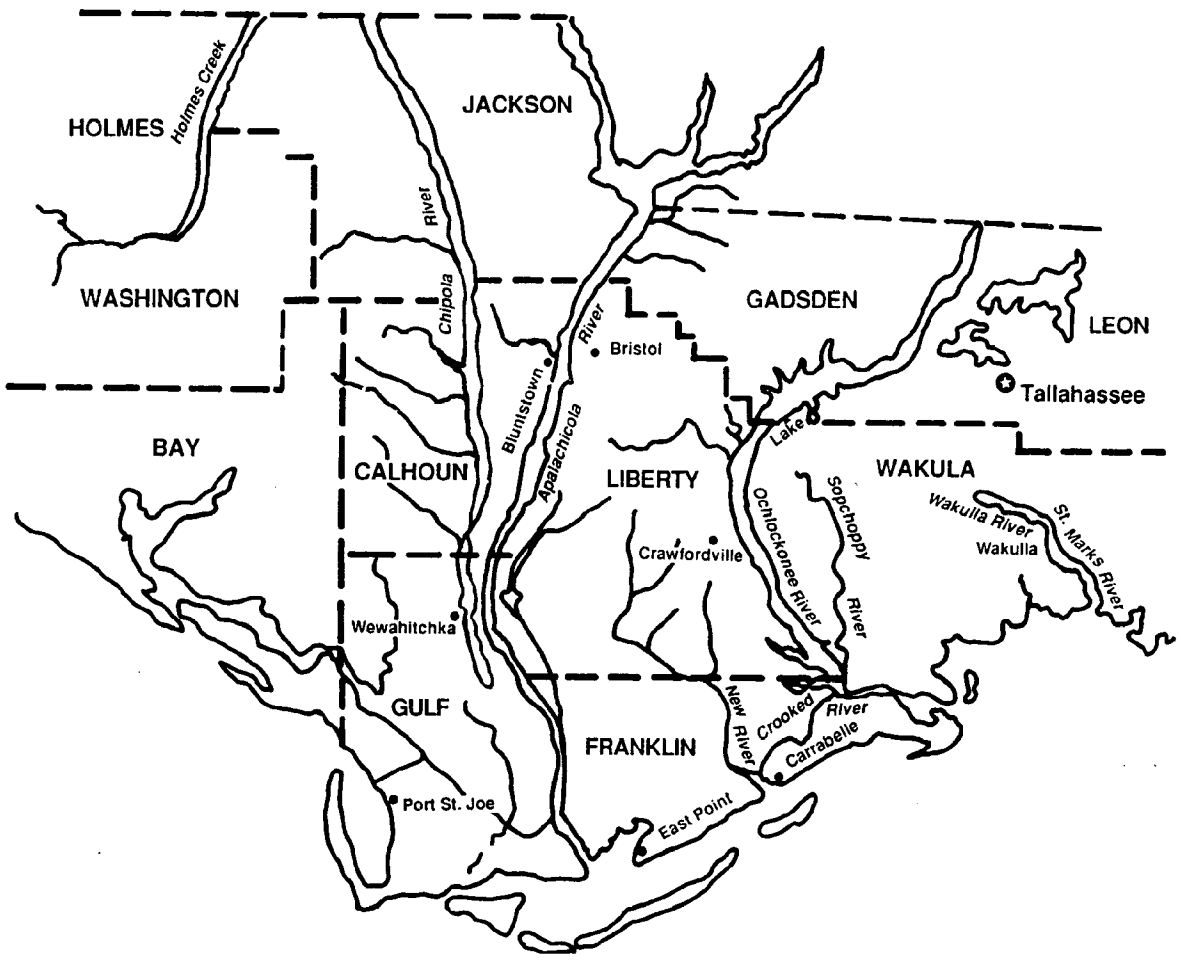
ACTIVITIES

"Estuary Search"

Materials needed: Blue, green, red, and #2 lead pencils, map of the Apalachicola estuarine system (See map provided), and list of 10 questions. You may copy the estuary map on acetate and use on overhead projector.

1. What is the name of your state? Using a regular pencil, write it on the map.
2. What is the name of your city? Locate it on the map and write it in with you pencil.
3. Find the river nearest to where you live. What is the name of that river? Write it in with a pencil.
4. In blue, trace the path of this river from its source to where it meets the sea.
5. With a green pencil, color in the salt water near the mouth of that river.
6. In red, circle where the fresh water river meets and mixes with the salt water from the ocean. This place is called an estuary. This will include our whole bay.
7. Find these rivers and trace their paths using blue. Wakulla River, Apalachicola River, Ochlockonee River, New River and Crooked River.
8. In red, circle the estuaries where these rivers meet the salt water.
9. Label the following cities with your regular pencil: Bristol, Blountstown, Port St. Joe, Apalachicola, Eastpoint, Carrabelle, Crawfordville, and Tallahassee.
10. How many of these cities are near an **estuary?**

Map for Estuary Search



Cormorant Origami

Materials needed: A six-inch square of black paper.

Directions:

1. Begin with the sea-gull base. Valley fold on the dotted lines so that the outer edges meet on the center line.

2. Valley fold on the dotted line.

3. Peak and valley fold on the dotted lines, and reverse fold the point outside in.

4. Peak fold on the dotted line, beginning at the body section and folding at an angle. Valley fold on the dotted line, and reverse the point outside in.

5. Peak and valley fold for the head section, and reverse fold outside in. Peak and valley fold and turn the corner in at the base of the neck.

6. Valley fold on the dotted lines in the head section, and reverse fold the point inside out. Peak and valley fold on the dotted lines in the tail section, and turn the point in then out again to form the tail.

7. Peak and valley fold on the dotted lines in the head to form the beak. Be careful to bend the tip slightly in to make the correct shape of a cormorant's beak.

Artwork Demonstrating the folding of a comorant

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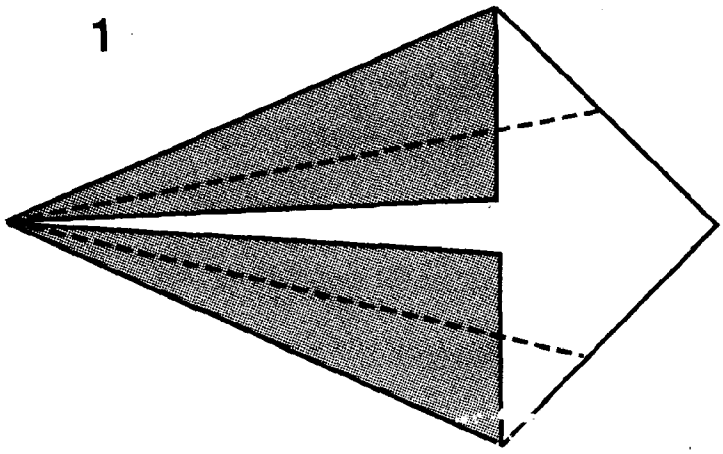

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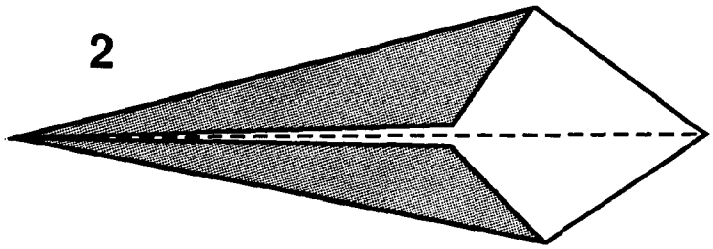

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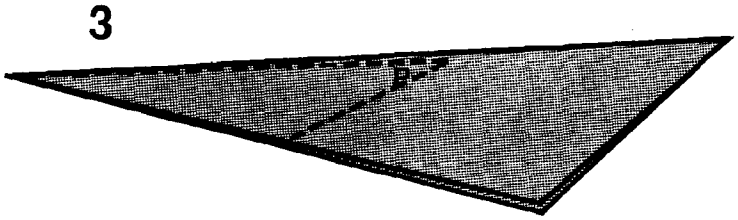

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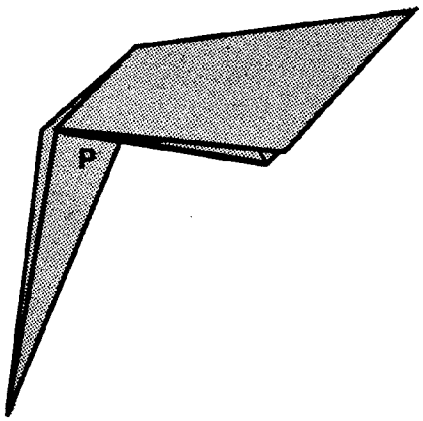

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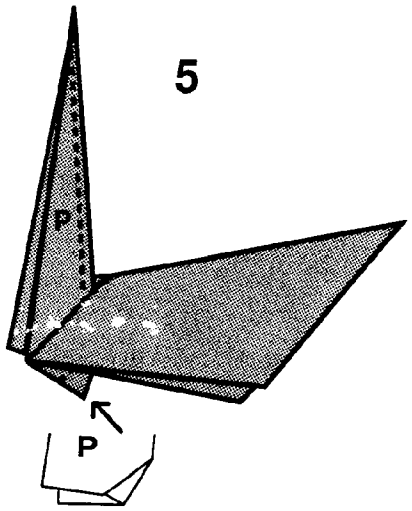

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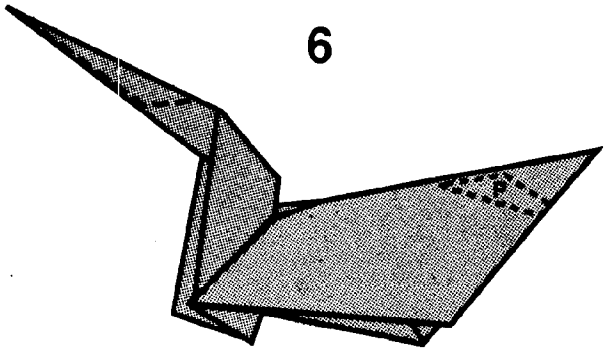

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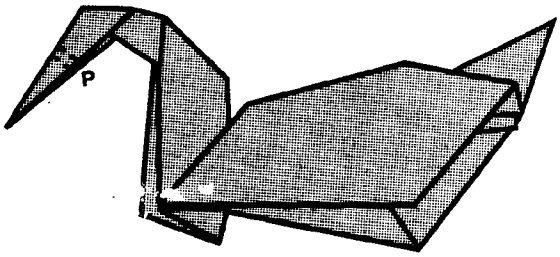
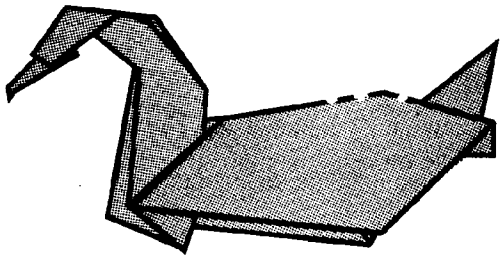




Draw a Mullet

1. Draw only the head of the fish on the chalkboard. As you are drawing, explain to the students that fish have a head, eyes with no eyelids, and a mouth. Ask the students to copy what you have drawn on their paper.

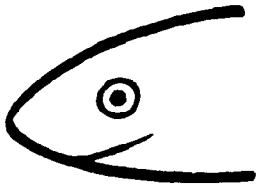
2. Draw the lines which form the body of the mullet. Explain that the body of this fish is long and streamlined. Ask students to copy what you have drawn.

3. Draw the lines of the tail. Explain that the tail propels the fish through the water. Ask the students to copy what you have drawn.

4. Draw the fins on the fish. Explain that fins are added to guide the mullet up and down as it swims through the water. Ask students to copy what you have drawn.

5. Add the line for the gill. Explain the gill helps the fish to breath under water. Ask students to copy what you have drawn. At the conclusion of this step, they should have a completed picture of a mullet!

1.



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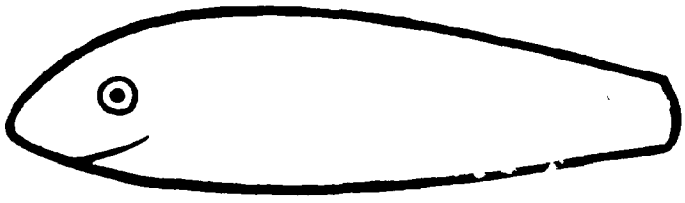

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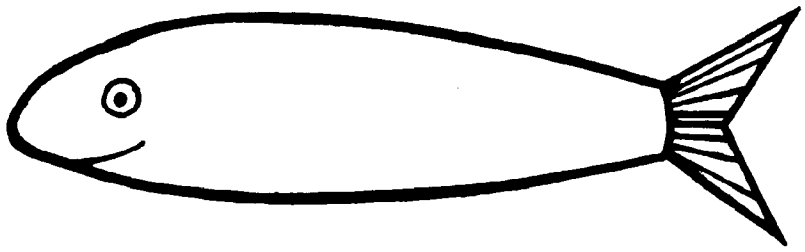

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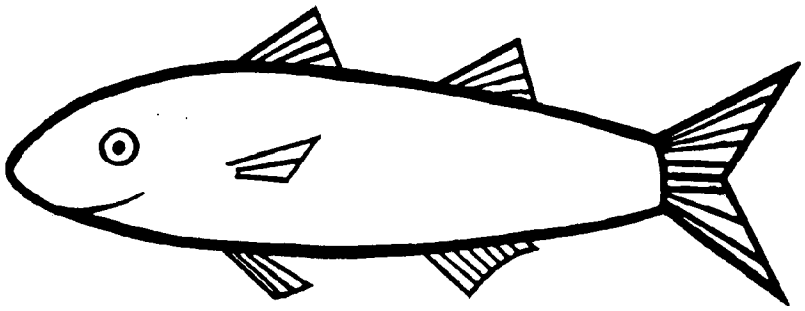

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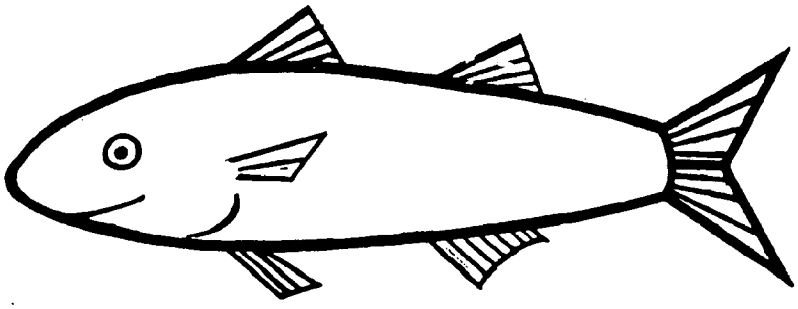


Quick Frozen Critter

Materials needed: Food token (card chips, pieces of card board) enough for three per student, labelling devices to mark predator, four or five hula hoops or string circles to serve as "cover", markers, pencils and paper to record number of captures, and whistle.

Procedure:

1. Select any of the following pairs of animals:

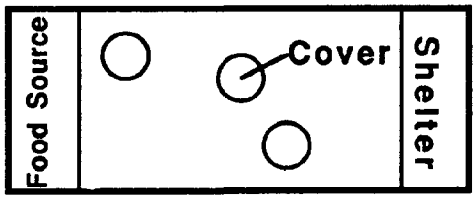
Prey	**Predator**
Snail	Shark
Blue crab	Common heron
Shrimp	Red fish
Sheephead minnows	Raccoon

   Identify students as either "predators" or "prey" for a version of "freeze tag" - with approximately one predator per every four to six prey.

2. Use a gymnasium or playing field. Identify one end of the field as the "food source" and the other end as "shelter".

3. Four or five hula hoops or string circles are placed in the open area between the "shelter" and the "food". These represent additional shelter or cover for the prey and can be randomly distributed on the field.

4. Food tokens are place in the "food source" zone on the ground. Allow three food tokens for each prey animal.



5. Predators should be clearly identified. Gym vest or safety patrol vest might be available or big name cards with possible picture display.

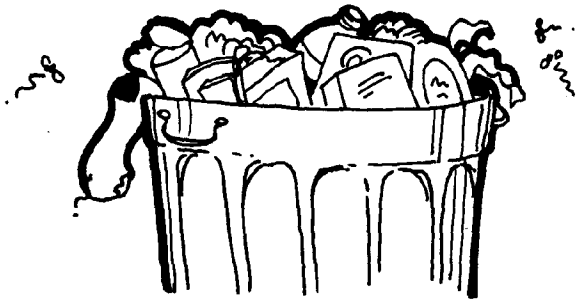
6. Use a whistle to start each round. When a round begins, prey start from their shelter. The task of the prey animals is to move from the primary shelter to the food source, collecting one food token, and returning to the primary shelter. To survive, prey have to obtain three food tokens. Their travel is hazardous, however. They need to be alert to possible predators. If they spot a predator, they can use various appropriate prey behaviors-including warning other prey that a predator is near. Prey have two ways to prevent capture: They may "freeze" or run to cover (with at least one foot in hoop).

7. Predators start the game anywhere in the open area, randomly distributed. Predators tag only moving prey. Predators must each capture two prey in order to survive. Captured prey are taken to the sidelines by the predator who captured them.

8. A time limit of five to seven minutes is suggested for each round of the game.

9. Play the game several times, allowing students to be both prey and predator.

Let's Find Natures Garbage Can!



Is dead seaweed garbage? Follow these direction's to find the answer. . .

1. Seaweed gets washed up on shore. Is it garbage? __Yes, go to #12 __ No, go to #9

2. Wrong. Nothing stays in the soil.

3. Right! Crabs, snails, worms, seagulls and other animals often eat dead things. Are there animals which eat live creatures? __Yes, go to #8 __No, go to #6

4. Wrong. Rotting is just another use for an animal. __Now go to #5

5. Right. When bacteria and fungi "rot" things, they return them to the soil. Is this where nature's garbage can ends up? __Yes. go to #2 __No, go to #11

6. Wrong. Animals like seals and great blue herons, for example, eat other animals. __Now go to #8.

7. Wrong. The nutrients in the bodies of dead things are not wasted in nature. __Now go to #3

8. Right! These animals are called predators. If an eagle eats a salmon then flies away and dies and rots, it garbage? __Yes, go to #4 __No, go to #5

9. Right! Many insects, like the beach hopper, live in dead seaweed. But what about the insects? Do they just die and become waste? __Yes, go to #10 __No, go to #13

10. Wrong. There are billions of insects, and if this happened the world would be buried in their bodies. __Now, go to #13

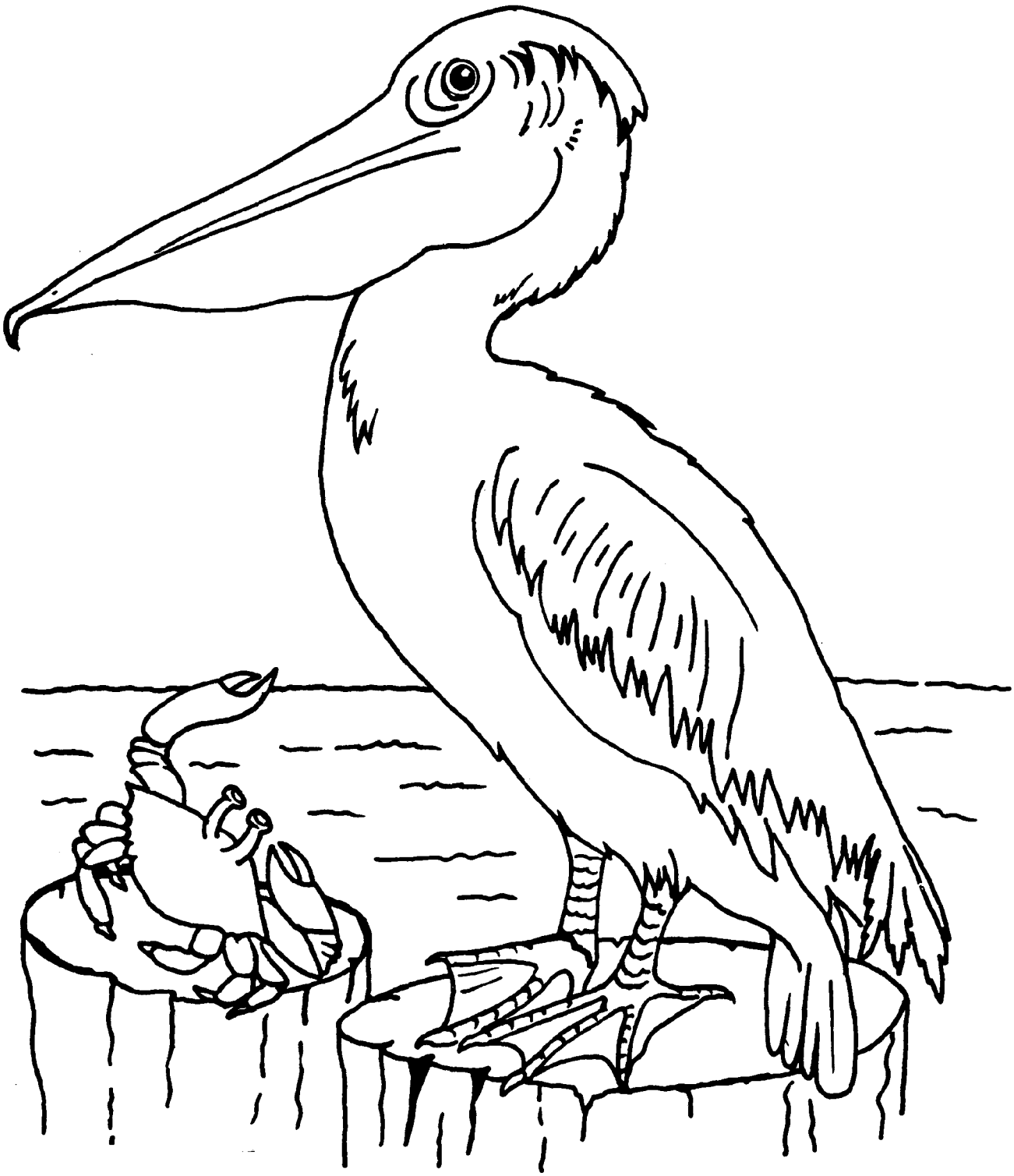
11. Right! Plants will use the nutrients from the soil and more seaweed will grow to replace what has died. And that brings us back to where we started . . at #1. There is no garbage in nature, because everything is re-used again and again in a circle.

12. Wrong. Dead seaweed has many uses. __Now, go to #9

13. Right! Insects are eaten by birds for instance. If a sandpiper eats an insect, but then the sandpiper dies, will its body be of any use? __Yes, go to #3 __No, go to #7

Pelican and Crab

The pelican's bill is designed for diving from the air after its prey and capturing fish in its pouch. There are white and brown pelicans.



River Whimsey

Material needed: Copies of River Whimsey, enough to hand out to each student.

Procedure: Read a short story and discuss while looking at pictures - - What's in Fresh Water?

RIVER WHIMSEY: WHAT A RIVER BRINGS TO THE ESTUARY

A whimsey is something light-hearted. It is changeable and dreamy. No one quite knows what's going to happen!

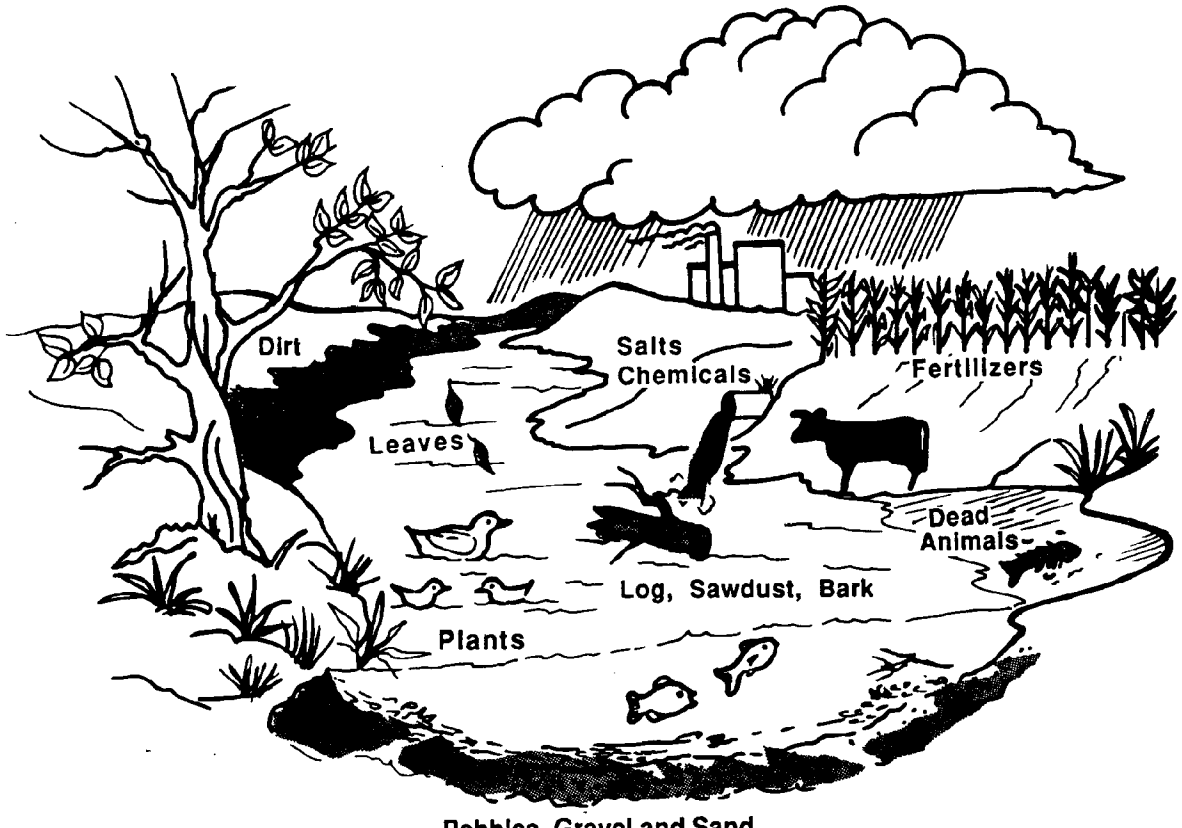
A river can be a whimsey. It may dance along, or flow slowly. It may change its course, or twist. Winter rainstorms make a stream wide and angry. But in summertime, a river may be like a pleasant winding creek.

An estuary can't say to a river, "Stop your waters from drowning my mudflats!" An estuary has to take what the river sends it. And yet, an estuary can't get along without the things a river sends it!

A river's whimsey can change an estuary. What the river brings along may help or hurt growing things.

What does a river bring down to the estuary? Fresh water! An estuary need fresh water. But many other things come down in the fresh water!

CLEAR DROPS, MUDDY DROPS — WHAT'S IN FRESH WATER?



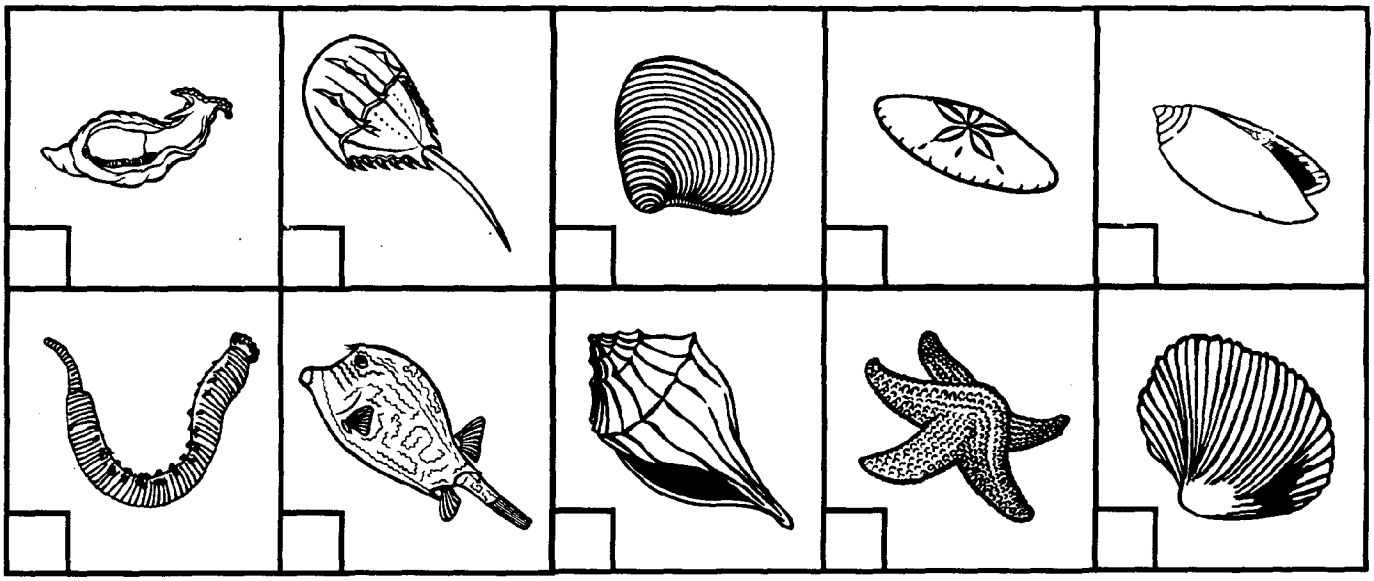
Low Tide

Take a walk along a Florida coast at low tide, especially after a storm, and who knows what creatures you might see.

Unscramble the letters below. You will spell the names of sea critters that you may find washed up on shore.

1. eas raeh _____ _____
2. sorhesoeh crab _____ _____
3. qhoaug clam _____ _____
4. lnasdoadlr _____
5. ilvoe lhels _____ _____
6. uwglrmo _____
7. woc hsfi _____ _____
8. elwhk shell _____ _____
9. trsfashi _____
10. lcokec shell _____ _____

Match each number of the sea critters, from above. Write the number in the small squares.



ANSWERS: 1. sea hare, 2. horseshoe crab, 3. quahog clam, 4. sanddollar, 5. olive shells, 6. lugworm, 7. cow fish, 8. whelk shell, 9. starfish, 10. cockle shell.

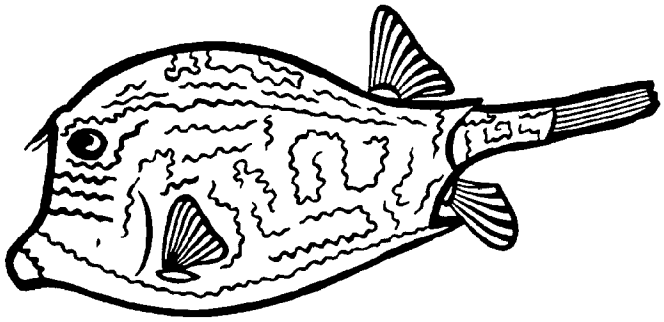
SUGGESTED SONGS*

* Can be checked out from Apalachicola National Estuarine Research Reserve.

"The Wetland Waltz"

"Zooplankton Cowboys"

("Songs From the Water World", by Jill Jarboe)



References

1. *Estuarine Ecology,* Mike Mullens, Jerry Murray, Philip Wirth, Office of Environmental Education.

2. Estuary Lesson - Los Marineios Program

3. *The Estuary Program,* Judy Friesem, Valerie Smith, Padilla Bay National Estuarine Research Reserve. Brezeale Interpretive Center.

4. *Estuary: An Ecosystem and a Resource,* Oregon State University Sea Grant College.

5. *Pickleweed Eddy's Salt and Marsh Book,* Marilee Miller.

Suggested Readings

1. "Edge of the Sea", Russel Sackett, Time-Life Books, Alexandria, VA.

2. *The Continental Shelf an Underwater Frontier,* Alice Gilbreath, Diller Press, Inc., Minneapolis, MN.

THE SALT MARSH

ESTUARINE HABITATS
SUPPLEMENTAL TEACHING ACTIVITIES

ACTIVITY BOOK IV

THE SALT MARSH

TABLE OF CONTENTS

Introduction to the Teacher

The Apalachicola National Estuarine Research Reserve was established in September 1979 as a cooperative effort between Franklin County, the State of Florida and the National Oceanic and Atmospheric Administration. The Reserve is administered by the Florida Department of Natural Resources.

The purpose of the Reserve is to support research relating to the Apalachicola River and Bay estuarine system, disseminate research information, educate the public about estuarine processes, and encourage resource protection.

The purpose of this packet and the other four in the series is to give you, the teacher, supplemental materials and activities for teaching about estuarine system habitats. This packet focuses on the salt marsh. The materials may be used to introduce a unit on the salt marsh environment or to expand a unit in progress.

The suggested readings listed in the reference section have been researched and selected by classroom teachers. We strongly recommend readings be used to enhance each activity.

Background Information

The Salt Marsh

Salt marshes are found on the bay side where they are protected by the barrier islands and associated with shallow low-energy (light wave action and tides). Salt marshes act as filters for land run off. The grasses remove sediments and pollutants. They transfer nutrients from upland areas to adjoining aquatic systems. They also act as control from flood water, recharging ground water, and habitat for waterfowl and wildlife. They are breeding and nursery grounds for fisheries, sanctuary for rare and endangered species, and hold educational, recreational and aesthetic value.

Barrens or bogs also exist in salt marshes. These barrens are devoid of vegetation and are covered by tides. As the water evaporates from these areas the salinity rises several times greater than that of the open sea. Peat deposits, which have built up after several thousand years of occupation by marsh plants, slow the percolation rate of water and thus helps to increase salinity. These deposits may become several feet deep and act as a natural fill in creating marshes.

Salt marshes are composed of a variety of plants: rushes, sedges, and grasses. Florida's dominant salt marsh species include: black needle rush, salt meadow cordgrass, smooth cordgrass, and sawgrass. All are tolerant of the salt in sea spray.

As salt marsh plants die and decompose they create organic detritus (di-'trit-es), another food source for many marsh dwellers.

The salt marshes are important because they create the base of the food chain. All of the wild animals large and small plus man are primary consumers of the bounties provided from this habitat.

FOOD CHAINS

Algae ➡	Fiddler Crab ➡	Croaker ➡	Diamondback Terrapin
Algae ➡	Silverside ➡	Hooded merganser ➡	American alligator
Detritus ➡	Shrimp ➡	Sea trout ➡	Man
Detritus ➡	Blue crab ➡	Man	

Common Plants and Animals of the Salt Marsh

ANIMALS

Insects
Marsh fly
Dragon fly
Sand gnats
Mosquito

Shellfish
Fiddler crab
Crabs
Pink shrimp
Salt marsh periwinkle snail
Clams

Fish
Anchovy
Croaker
Silver-sides
Gulf menhaden
Sea trout

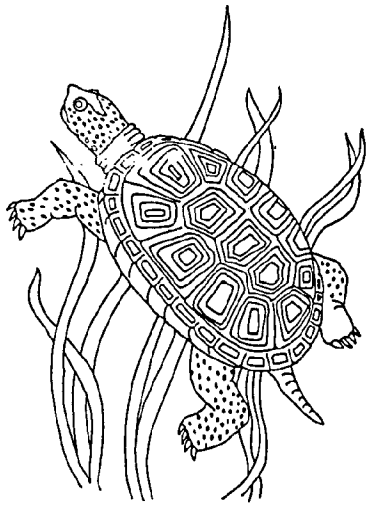
Reptiles
American alligator
Diamondback terrapin

Birds
Redwing black bird
King fisher
Hooded merganser
Great blue heron
White ibis
Red head duck
Osprey
Sand piper

Mammals
Raccoon
Otter

PLANTS

Black needlerush
Smooth cordgrass
Sawgrass
Glasswort
Cattail
Salt meadow grass
Sand sedge
Salt marsh cordgrass



ACTIVITIES

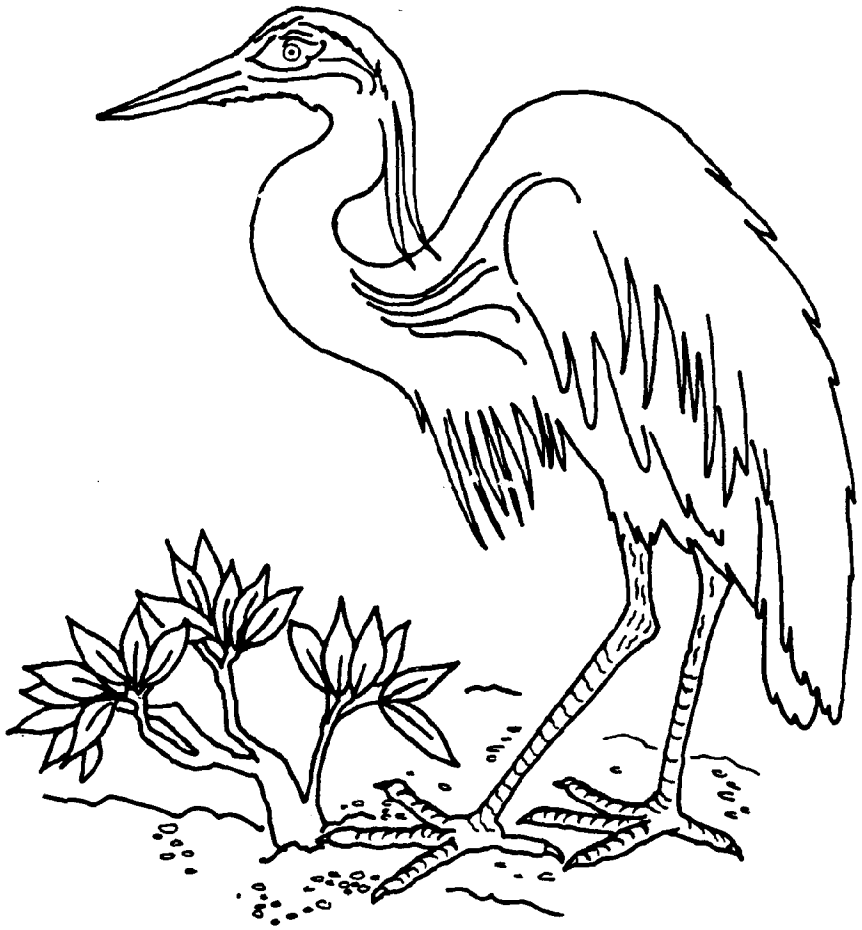
Overhead Projector Story, "Living on the Mud Flats"

Materials needed: Overhead projector, glass bowl, bb's, water, straw, several cut straws, purple food coloring, alka-seltzer tablet, (optional plastic egg).

Put a clear glass bowl on the overhead projector. Tell this story.

The salt marsh is protected and has little wave action. The fine grained mud flats (drop bb's into the bowl to represent the fine grains of the mud); hold the water because they are level and they don't drain (add water to the bowl).

There is water exchange in the first few centimeters of the mud which allows oxygen into the mud. (Take a drinking straw and blow bubbles in the water to represent the oxygen). Animals called tube dwellers construct tubes so that they may live deeper in this habitat and still get oxygen rich water above the mud. (Stick several short pieces of straw into the bb's to represent the tubes). Many polychaete worms live on the mud flats, moving deeper into the mud (add more bb's and water dyed with purple food coloring). There is little water exchange in the mud so this area has very little oxygen. Few microscopic organisms live in this zone. Chemical reactions are taking place in this zone. (Add an alka seltzer tablet). Hydrogen sulfide is produced in this zone which is the rotten egg smell you often smell in the mud of a salt marsh. I just need to add a little rotten egg to the mud to show you how it smells. Are you ready? (Take a plastic egg and act like you're going to add a rotten egg).



Camouflaged Critters

Materials needed: colored strips of paper, colored toothpicks

Directions:

Hide colored strips of paper around the room. Have students find the strips. Some strips should be easy to find because the colors are different than the background. Some are harder as they blend with the background. Hide a matching strip on your shoe. See if they can find it.

OR

Go outside and drop colored toothpicks. See which colors are most easily found and which are hardest to find.

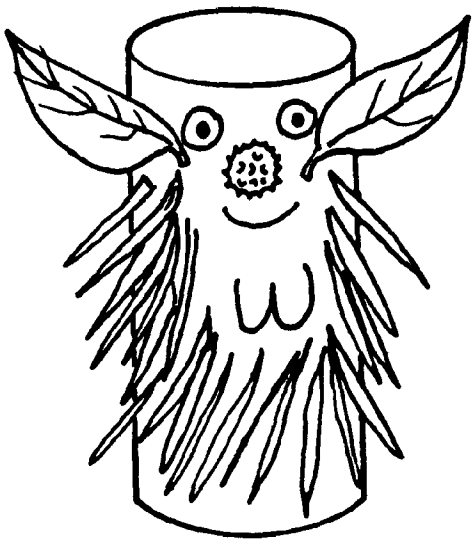
Camouflage Tubes

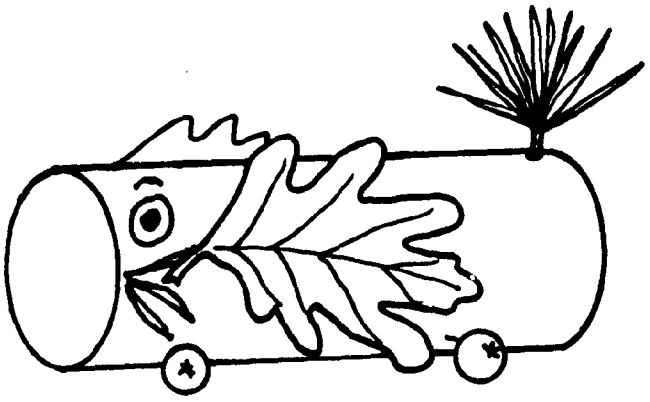
Materials needed: Toilet paper tubes, twigs, and grasses

Directions:

Animals living in the salt marsh develop many adaptation behaviors. One of these is camouflage for survival.

Have each child decorate a toilet paper tube with twigs and grasses from an area surrounding the school. Have the children hide their camouflaged animals and then take turns looking for them. The goal is to show the child how valuable such adaptive behavior can be.





Create A Mural

Materials needed: Marsh grasses, glue, copies of mural background and crayons.

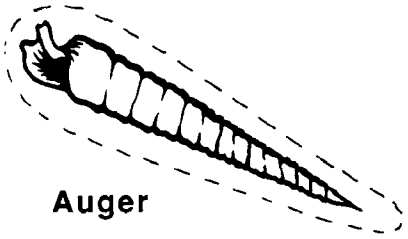
Directions:

The students will create a mural using juncus or other marsh grasses. They will draw in the animals and sediments collected by the grasses.

Salt Marsh Snails

Material needed: Copies of snail pictures, drawing paper, glue, and crayons.

Have students draw emergent plants and hide their snails on the salt marsh. Make sure plants are larger in size than the snails.



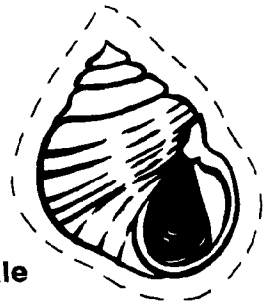
Auger

Woven Circle-Mouth

Angled Modulus

Sargassum

Common Periwinkle



Soil - Clay - Sand Experiments

Materials needed: Three cans, one filled with red clay, another with garden topsoil, another filled with sand, and water.

Directions:

Pack the sand and soil down and pour an equal amount of water on top of each. Watch what happens.

Observation:

The water poured into the sand will pass through it rapidly. Water poured into the clay will stand on top of it a long time. Water poured into the topsoil will seep into it slowly and be held there.

Animals have to develop different behavior to adjust to life on the mud flats.

There is the most oxygen in the sand as the particles are spaced further apart. The least oxygen is found in the mud or the particles are close together. For animals to live on the mud flats of the marsh they must adapt. The most common adaptation is tubes which go to the surface so the animal can get oxygen even though they live well below the surface of the mud were the oxygen is limited.

Are You Me?

(Adapted from *Aquatic* ***Project WILD***)

Materials needed: Two pictures from home; baby and student, several adult and young animal matching pictures and index cards.

Procedures:

1. Make several pairs of aquatic animal cards with the pictures and index cards. The animals in each pair should be the same kind (adult and young).

2. Ask children to bring two pictures from home. One should be of an adult, the other picture of a child, or student/infant.

3. Select a few pairs of pictures. Mix them up. Have a few students who are not familiar with the pictures try to match the pairs.

4. Introduce the aquatic cards and divide the class in half. Designate one half of the students "adults" and the other half "young animals". Give each student in the adult group an "adult" animal image. Give eachstudent in the "young animal" group a "young animal" image. Make sure there is a corresponding match, adult or juvenile, for each card given. Instruct students to look for their "match".

5. When all the students have made their choices, let everyone help to see if the matches are correct.

6. Have students look at all of the correctly matched pairs. Look at similarities and differences in how aquatic animals grow and change.

Suggested Pictures to Use:

Osprey	Blue crab
Skate	Fiddler crab
Alligator	Marsh fly
Black fly	American alligator
Mosquito	Sea trout

Create a Fish

Materials needed: Pictures of various different fish, string, scissors, hole punch devise, stapler, paper plates and crayons.

Procedure:

1. Show students the pictures of fish and discuss with them why different fish have different adaptations for mouth, fins, body shape, and protective coloration and camouflage.

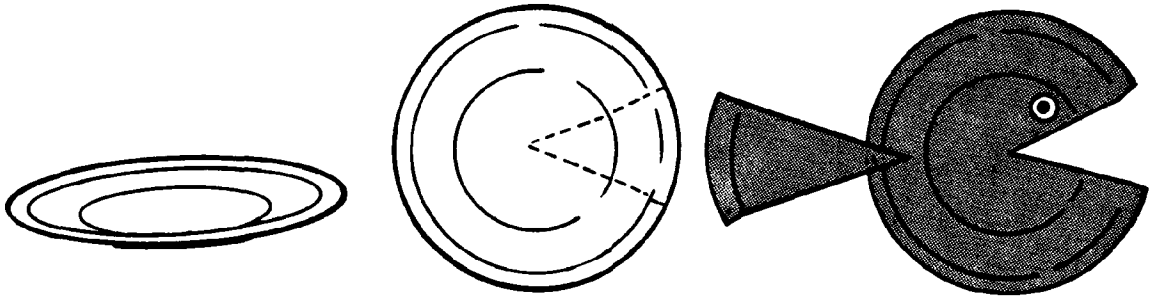
2. Give each student a paper plate, crayons and student scissors. Have them cut a triangle out of the plate (pie shape) to use as a tail fin (caudal fin).

3. With the stapler, attach the fin to the student's paper plate like so: Now the fish will have a mouth and a tail!

4. Instruct students to create a fish remembering to make other fins, gills, eyes, a decided body shape and caudal fin shape and protective coloration and camouflage.

5. As students complete their fish, punch a hole near the top of the fish and loop a string through it so the fish can be hung and displayed.

6. Have each student name and explain his or her fish and its' special adaptations.

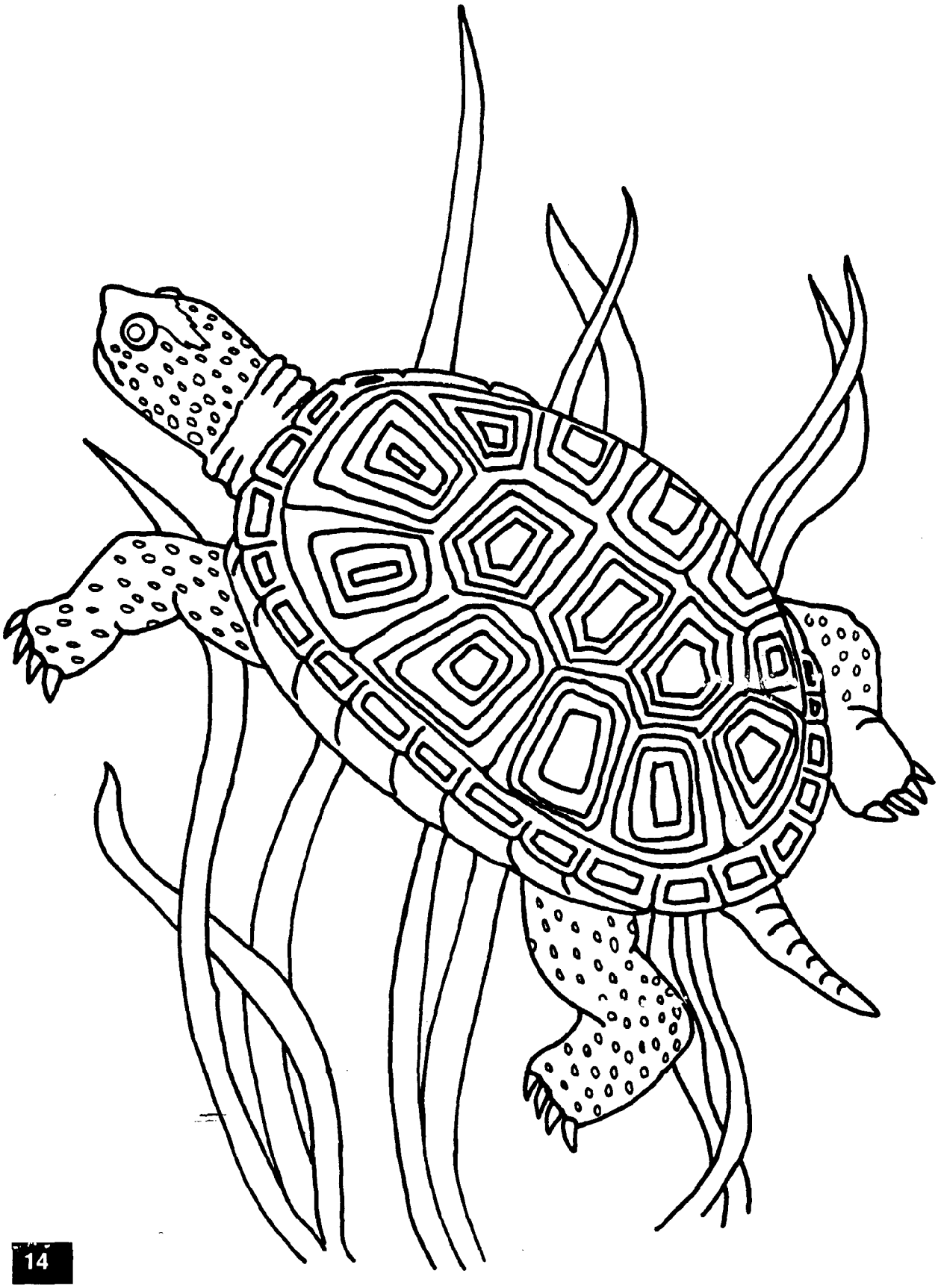


Adaptation Information for the Teacher

Adaptation	Benefit or Use
Mouth	
Sucker mouth	Eats small plants and animals
Longer upper jaw	Eats animals below it in water
Longer lower jaw	Eats animals above it in water
Beaklike jaw	Grabs prey
Huge mouth	Encloses and gulps prey
Fins	
Caudal (tail) fin	Moves fish forward
Dorsal (top) fin	Stabilizes fish
Pelvic (bottom) fins	Stabilize and help stop and turn
Anal fin (bottom, behind pelvic fin)	Stabilizes fish
Pectoral (side) fins	Stabilize and help stop and turn fish
Body Shape	
Torpedo shape	Rapid movement
Flat bellied	Feeds on bottom
Flattened side to side	Feeds below or above
Flattened top to bottom	Lives on bottom
Hump backed	Stabilizes fish in rapid moving water
Protective Coloration and Camouflage	
Dark topside and light bottomside	Blends with lightness or darkness of water so predators cannot see it as well
Stripes	Break up outline so not as easily seen
Eyespot on tail	Confuses predators
Mimic of background	Predators cannot see it as well

Diamondback Terrapin

The terrapin is found in salt or brackish water. It feeds on crabs, plants, and shellfish.

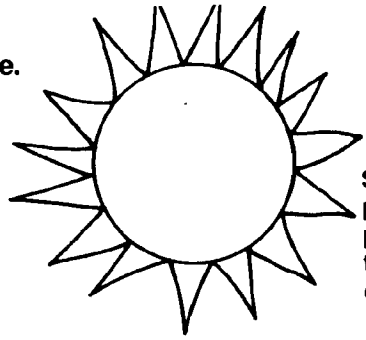


Raccoon To Color

3 A-MAZE-ING Salt Marsh Food Chains

Follow these three food chains through the maze.

1. Plankton ➡ Fish ➡ Great Blue Heron.
2. Algae ➡ Fiddler Crab ➡ Fish ➡ Terrapin
3. Detritus ➡ Fiddler Crab ➡ Fish ➡ Man



SUN
plankton and green plants use the sun to make carbon-energy sugar

SONG

"Salt Marsh Food Chain"

Tune: Farmer in the Dell

The dying plants decay,
The dying plants decay,
Hi Ho the marsh is so,
The dying plants decay.

The shrimp eat detritus,
The shrimp eat detritus,
Hi Ho the marsh is so,
The shrimp eat detritus.

The killifish eat the shrimp,
The killifish eat the shrimp,
Hi Ho the marsh is so,
The killifish eat the shrimp.

The trout eat the killie,
The trout eat the killie,
Hi Ho the marsh is so,
The trout eat the killie.

The porpoise eats the trout,
The porpoise eats the trout,
Hi Ho the marsh is so,
The porpoise eats the trout.

The porpoise meets his end,
The porpoise meets his end,
Hi Ho the marsh is so,
The porpoise meets his end.

The porpoise decays,
The porpoise decays,
Hi Ho the marsh is so,
The porpoise decays.

Reference Tape

Songs from "The Water World", By Jill Jarboe

1. "The Underwater World Is A Wonderful Place"
2. "Give Me The Green Things"

References

1. The Audubon Society Nature Guide to "Wetlands", by William A Niesing: Borzoi Book published by Alfred A Knopf, Inc.

2. *Florida Salt Marshes,* Florida Department of Natural Resources, Bureau of Marine Resources

3. Adapted from *Aquatic Project WILD* - Western Reg. Environmental Education Council, 1983.

4. "Resource Inventory of the Apalachicola River and Bay Drainage Basin", Florida Game and Fresh Water Fish Commission (Lee Edmiston and Holly Tuck)

Suggested Readings

1. *Snowy Takes a Tumble,* Joseph F. Branney, Ranger Rick, May 1979.

2. Tide Swamp Wildlife Management Area, Steven K. Stafford, Florida Wildlife, February, 1975.

THE BEACH

ESTUARINE HABITATS
SUPPLEMENTAL TEACHING ACTIVITIES

ACTIVITY BOOK V

THE BEACH

TABLE OF CONTENTS

Introduction to the Teacher

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The suggested readings listed in the reference section have been researched and selected by classroom teachers. We strongly recommend readings be used to enhance each activity.

Background Information

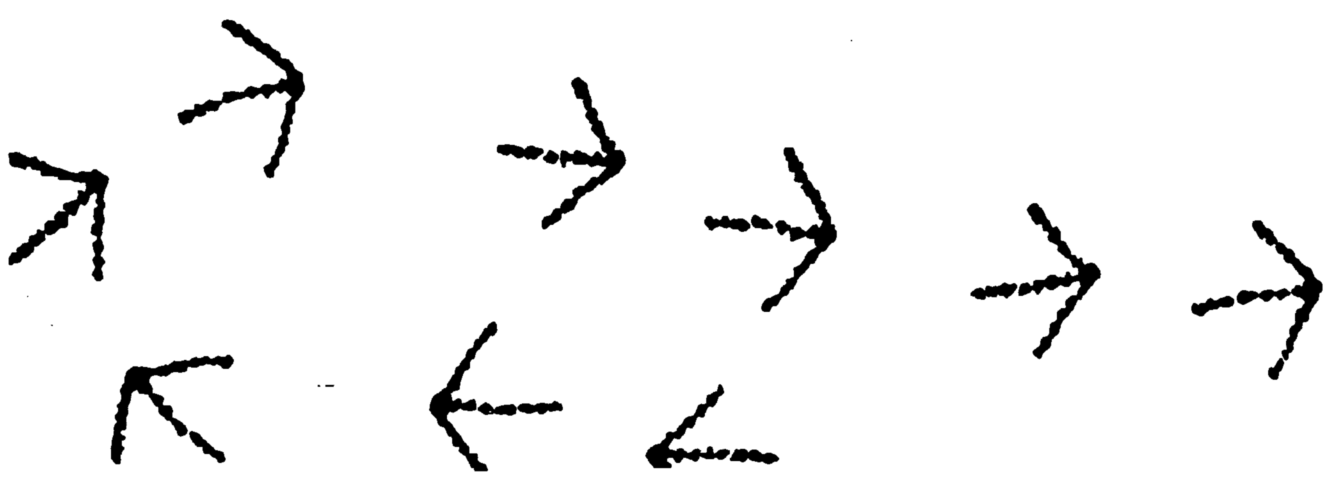
The Beach

The beach is the place between higher ground, such as sand dunes, and the water. Beaches are high energy areas continuously assaulted by waves and tidal action. Along the Gulf Coast, beaches are mostly made of sand. Ocean beaches are usually covered with broken shells, seaweed, and debris washed in from the sea. Relatively few organisms make their homes directly on the beach or shoreline because of the harsh environmental conditions. No large plants grow in these areas because waves continuously pound the beaches. Organisms living along the shoreline or in the water must be adapted to the pounding waves and changing tides. Beach inhabitants such as clams, crabs, and coquinas escape the pounding by burrowing in the sand. Beach fleas spend their time under sand or debris on the beach. Sand not only provides escape from the pounding waves, it also provides some degree of protection from the searing sun and predators.

Shorebirds are common predators on the beach. Gulls, sandpipers, and oystercatchers are often seen foraging for food at the waters edge. Many types of shorebirds probe into the sand in search of edible organisms.

Beaches can also be made of mud. These beaches form only in protected areas where wave action is less severe. Tube-dwelling worms are the dominant inhabitants of mud beaches. Mud beaches often rim estuaries.

Common plants and animals of the beach area and sample food chains are listed on the next page. A food chain is an arrangement of organisms of an ecological community according to the order of predation in which the next higher member uses the lower member as a food source.



FOOD CHAINS

ALGAE ➡	MUD SNAIL ➡	BLUE CRAB ➡	MAN
DETRITUS ➡	WORM ➡	KILLIFISH ➡	FLOUNDER ➡ MAN
DETRITUS ➡	SAND SHRIMP ➡	SEA CATFISH ➡	MAN
MORNING GLORY ➡	GHOST CRAB ➡	GULL	

Common Plants and Animals of the Beach Area

ANIMALS

Worms
Ribbon Worm
Lugworm Worm
Nereid Worm

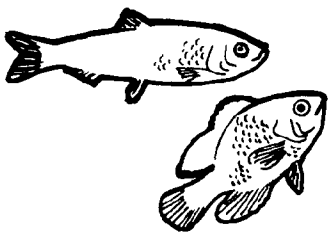
Shellfish
Mole Crab
Blue Crab
Fiddler Crab
Ghost Crab
Razor Clams
Hard Shelled Clams
Sand Shrimp
Mud Snail

Fish
Flounder
Killifish
Sand Sea Trout
Sea Catfish

Shore Birds
Gulls
Willet
Sandpiper
Tern
American Oystercatcher
Black Skimmer

PLANTS

Sea Oats
Beach Morning Glory
Turtle Grass
Algae
Purslane
Sea Lettuce



Create A Beach Picture

Materials needed: Copies of the beach scene page or drawing paper, sand, copies of the beach critters page, colors, scissors, glue.

Have the children spread glue over drawing paper or a copy of the beach scene (page 2) and sprinkle sand on the paper. Let dry and shake off excess sand. Make copies of the beach critters page for each of the students. Have children color and cut out the pictures of the critters. Have children glue critter pictures to the paper to complete the beach scene.

Sorting Shell Pictures

Materials needed: Copies of the shell pages and scissors. (optional: drawing paper, glue)

Directions: This is a good activity for reinforcing categorization skills. Make copies of the shells on pages 9 and 10 for each student. Ask the students to cut out the shells and group them into gastropods and bivalves. You may wish to have the students paste the shells on another paper and label them.

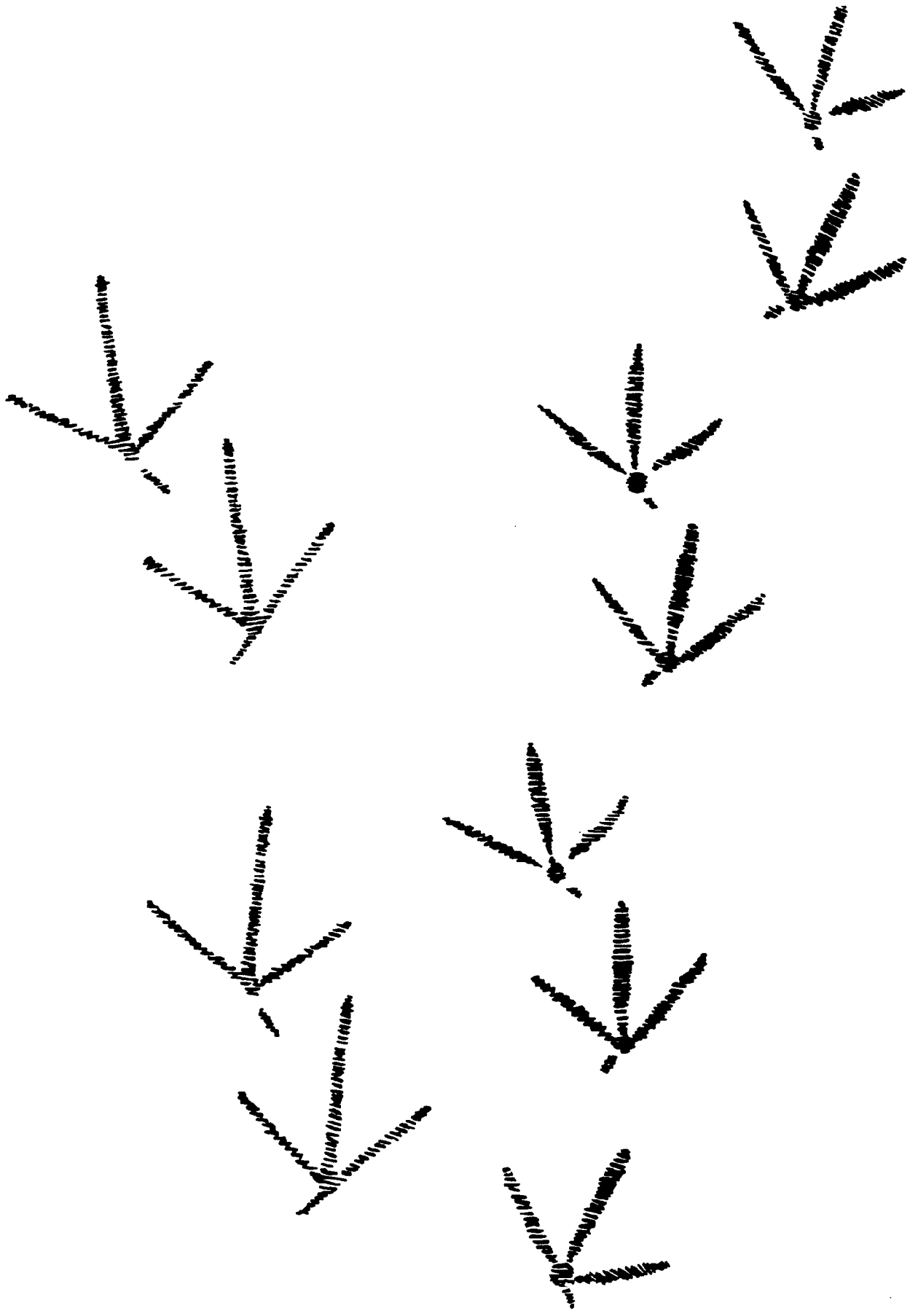
1. **Gastropods (one shell)**
    1. Olive
    2. Alphabet cone
    3. Whelk
    4. Tulip shell
    5. Paper fig
2. **Bivalves (two shells)**
    1. Scallop
    2. Cockle
    3. Luncine
    4. Coquina

Making Potato Prints of Shorebird Tracks

Materials needed: Potato, knife, ink or tempera, ink pad or sponge, drawing paper.

1. **Cut a potato in half.**
2. **Cut away part of the flat surface to form a relief pattern of a bird's track. (Refer to bird track pattern page 7.)**
3. **Apply ink or tempera paint to the track pattern, using an ink pad or a sponge that has been dipped in tempera paint. If using paint, squeeze excess out of sponge before applying to the potato.**
4. **Press the inked surface onto a piece of paper. Lift potato to leave print. Have children print tracks across the paper as though the bird was walking on the beach.**

This is a great story starter.



Beach Critters

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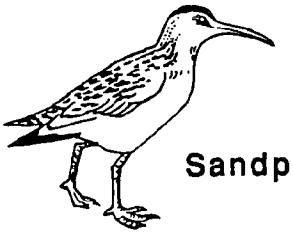
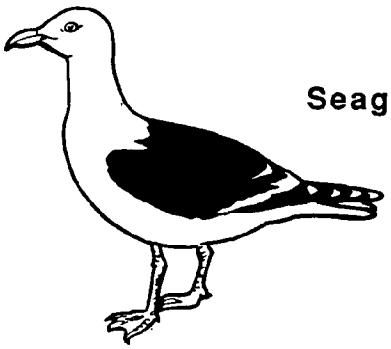
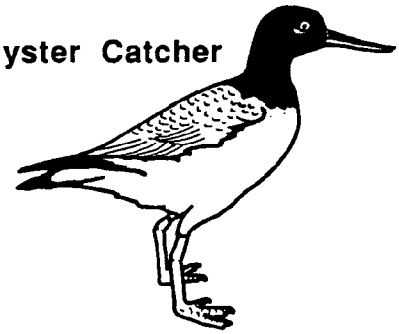


Sandpiper

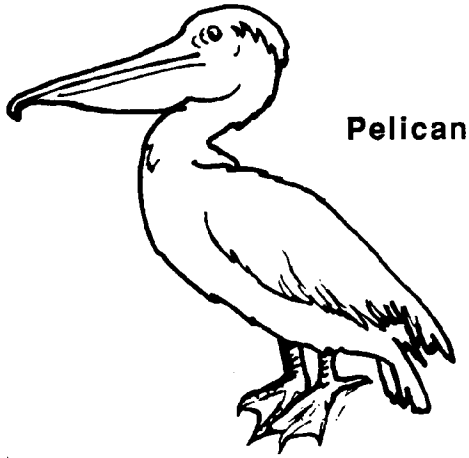


Seagull



Oyster Catcher

Coquinas

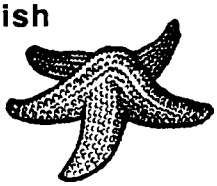


Pelican

Hermit Crab

Sanddollar

Starfish

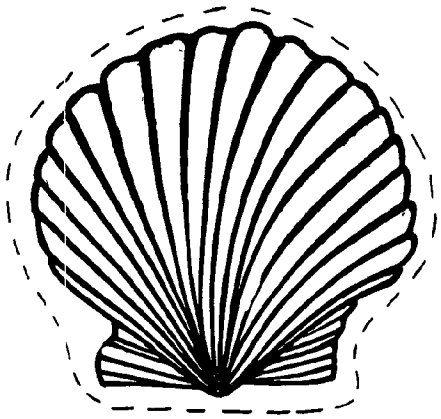


Shells

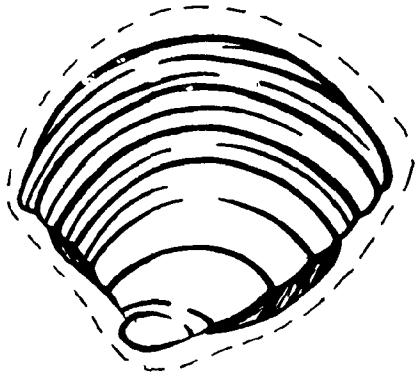
Sand Fleas

Ghost Crab

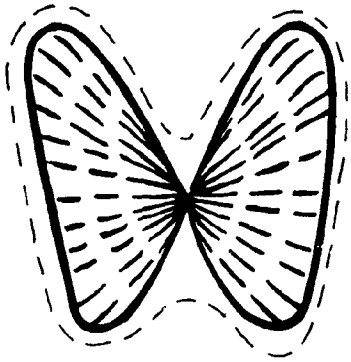
Shells



Bay Scallop

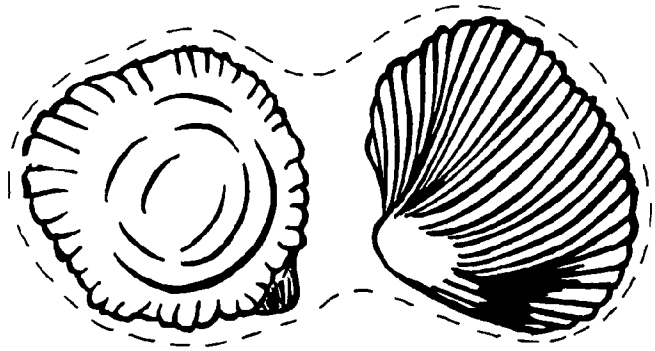


Thick Lucina



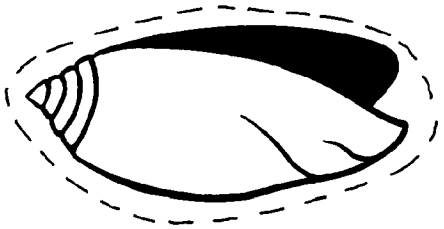
Coquina

Atlantic Slipper

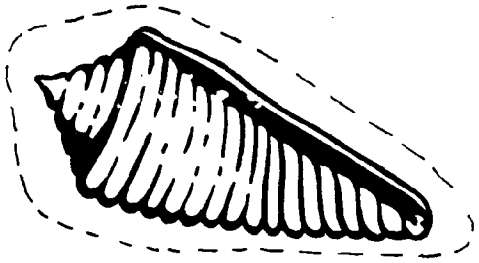


Cockle

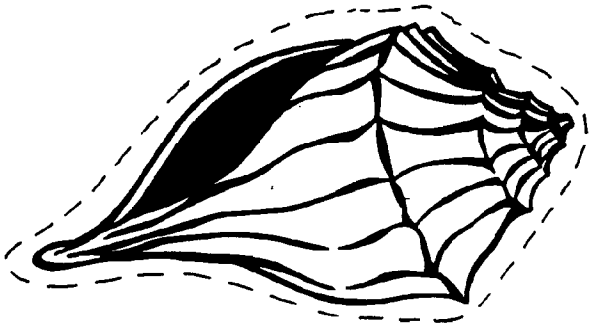
Shells
(for cut and paste)



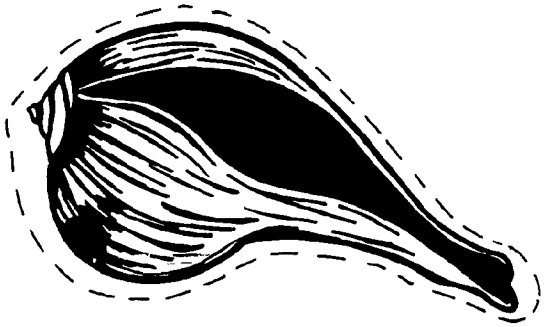
Olive



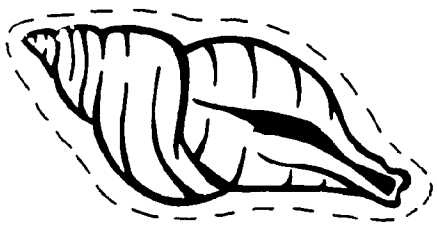
Alphabet Cone



Lightning Whelk



Paper Fig



Tulip

PUPPET SHOW

23 Characters

When presenting the puppet show a table should be used. The table top should be the beach surface. The burrowing animals should perform below the table while others perform at table top level.

Narrator
Hugo Gull
Gertie Sandpiper
Sherry Cherrystone Clam
Mole Crab
Eight Mud Snails
Merlin Mud Snail
Sandy Lugworm
Sidney and Sarah Bacteria
Long John Ribbon Worm
Reesie and Rufus Razor Clam
Rodney the Human
Airplane
Red Worm
Rocky Racoon

DESIGNING PAPER PLATE PUPPETS
Paper plate Ideas

Hugo Gull - Add a bill to a white plate.

Gertie Sandpiper - Color the plate brownish-gray with a long thin pointed beak.

Sherry Cherrystone Clam - Fold the paper plate so you can open or close the clam.

Mole Crab - Fold the paper plate and add two feathers for feelers.

Merlin Mud Snail - Draw a spiral shell and add two straws for snorkel and tongue.

Long John Ribbon Worm - Completely cover the paper plate with a long piece of yarn.

Sidney and Sarah Bacteria - Don't use a plate as they are microscopic. Have children speak in a small, high pitched voice for these two parts.

Rodney - Draw a face on the plate. Add construction paper ears. Make a rake.

Airplane - Add wings to a paper plate. Blow bubbles for the spray.

Sandy Lugworm - Cut the center circle out of the plate and color the rim.

Reesie and Rufus Razor Clam - Fold the plate in thirds. Add a foot and two short pieces of straw at the top.

Red Worm - Cut the center circle from a paper plate and color the remaining plate red.

Class Paper plate Puppet Show

Narrator:

Each day the tide slowly rises along the coast, covering a part of the beach and giving added protection to the critters which live below the surface of the sand. And each day the tide falls back uncovering the sand, and exposing these beach dwellers to their predators.

Hugo Gull (flies down): I caught this clam with my beak.

Sherry Cherrystone Clam: Help, he's got me! I'll hold my shell tightly closed. He'll never eat my soft body.

Hugo Gull (flies off): I dropped my clam.

Sherry Cherrystone Clam (hits the ground): Ouch, my shell has cracked.

Hugo Gull (flies down): I love eating the soft body of clams. What an easy meal with the hard shell opened for me. Low tide is a good time to feed.

Gertie Sandpiper (Lands nearby scraping the wet sand with pointed wing tips): Now for lunch. (Again and again she pushes her long bill down into the sand leaving little round holes. Tiny footprints mark her progress along the edge of the waves.) Watch out mole crabs! You don't have a chance. I'll find you. I'll eat a few mole crabs.

Narrator:

Each kind of animal adapts to the tidal changes in its own way. Many dig deeper into the sand, where they stay cool and moist. Under the sand they are safe from rain and winds and the temperature changes only slightly. Predators such as shorebirds have to work hard to find their food in sand burrows.

Merlin the Mud Snail: Now that the shore birds and fish have eaten. My gang and I are just like garbage trucks. We're here to clean up the ruins. Here come my friends one, two, three, four, five, six, seven, eight. We'll get the beach cleaned up. We'll eat anything that's left over. Come on gang let's bury under the sand. Let's all put up our snorkel-like tubes to draw in water. I'm getting plenty of oxygen from the water through my snorkel. Are all of you?

#1 Mud Snail: I am.

#2 Mud Snail: I am.

#3 Mud Snail: I am.

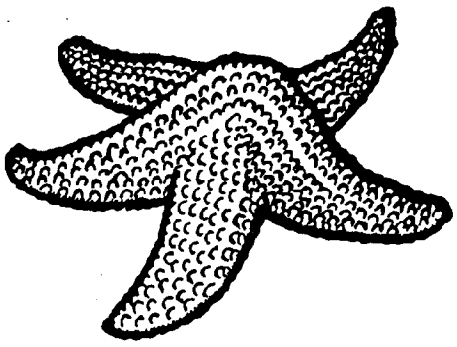
#4 Mud Snail: I am.

#5 Mud Snail: I am.

#6 Mud Snail: I am.

#7 Mud Snail: I am.

#8 Mud Snail: I am.



Red Worm enters.

Merlin Mud Snail: I'm Merlin the mighty mud snail. I detect traces of food juices coming through the water. Ready gang. Let's head for the surface. I'll just shake off the sand.

#1 Mud Snail: Me too.

#2 Mud Snail: Me too.

#3 Mud Snail: Me too.

#4 Mud Snail: Me too.

#5 Mud Snail: Me too.

#6 Mud Snail: Me too.

#7 Mud Snail: Me too.

#8 Mud Snail: Me too.

Narrator:

Once Merlin reaches the worm he stretches out his mouth tube, which is longer than his entire body. His mouth tube is tough and muscular with a special sort of tongue which is as rough as the roughest sandpaper.

Merlin the Mud Snail: I'll wrap my foot around that slender reddish worm Scrape, scrape. That worm's all gone. Now for another. The gang and I will clean up here. We never let garbage pile up on the beach. Everyone calls us the clean-up gang.

Sandy Lugworm: Just call me Sandy. My friends and I can eat our way through more than 1900 tons of sand a year and on a good year 800,000 five pound buckets of sand go through us.

Sidney Bacteria: Hi, I'm Sidney Bacteria.

Sandy Lugworm: All lugworms can lug sand but I'm the best of them all. Why friends count on me to dig through the top two feet of sand and make it soft and light so they can burrow down more freely.

Sarah Bacteria: Hi, I'm Sarah Bacteria. My brother and I are two of Sandy Lugworms smallest friends.

Sandy Lugworm: Even my smallest friends are important to me. Why Sidney and Sarah Bacteria always get the oxygen they need to do their job because of me.

Sidney and Sarah Bacteria: We break down dead plants into particles small animals can use.

Sandy Lugworm: What a dirty job you two have. Messing with these dead plants. I couldn't touch that dead stuff.

Merlin Mud Snail: Look. There is Long John Ribbon Worm. Do you remember when we called him Little John?

Long John Ribbon Worm: Do ya'll want to play hide and seek after dark?

Merlin Mud Snail: Come on Sandy. I'm not playing. You know he hides all day from the shore birds but once they leave he's out hunting.

Sandy Lugworm: It isn't any wonder he never stops growing because he seldom misses his prey. He's such a good hunter.

Long John Ribbon Worm: I'm such a good hunter. I can harpoon my prey without leaving my burrow. If I want to.

Merlin Mud Snail: I remember the time you just escaped. Yea, that young blue fish caught your tail.

Sandy Lugworm: Snap! Then Long John swam away with only half his body. We called him Little John.

(Sandy, Merlin, Long John, Sidney and Sarah sing: Snap! Goes the Worms Tail – see page 17.)

Long John Ribbon Worm: That didn't last long. I vanished into my burrow and before long I'd grown a new tail. I'm unbelievably stretchy. Not even a rubber band is so stretchy. I've got all that slime.

Sandy Lugworm: He always wins at hide and seek because even if you're lucky enough to catch him. He's hard to hold. If you hold on too tight he'll break apart and get away leaving tail and all behind.

Long John Ribbon Worm: I can live for months without food. But when I get ready to eat I just whip out my snout when I smell my prey. It flows out as smooth and straight as a harpoon line. It slides out and wraps around my prey. Slime streams from my snout tangling the prey beyond any chance of escape. (Reesie and Rufus enter.)

Sherry Cherrystone Clam: Here come the razor clams. They always want to race.

Reesie Razor Clam: Hi, Rufus. Let's race.

Sherry Cherrystone Clam: Razor clam races always begin when Reesie and Rufus get together. Reesie is faster than Rufus even though she is smaller. Those razor clams have streamline bodies and a huge "foot". They are designed for speed. Their shells are long, narrow, and squared off at the end like a straight razor.

Rufus Razor Clam: Reesie named me the jackknife clam. My shell looks like the knife handle and the foot looks like the blade. I move in a series of jerks. My foot pushes down beyond the shell. Down, down, I push.

Reesie: I'm ahead. My body muscles tighten, and my shell slides down to meet my foot. My foot pushes down again and the rest follows. I'm still ahead. What a race.

Narrator:

Now that the race is won, they have settled down for a victory dinner, clam style. Sticking out at the top edge of the shells are two gray tubes or siphons. One draws in new water and the other flushes out stale water. With water, the clams get more than oxygen. Floating in the sea are thousands of one-celled plants call diatoms. Diatoms are so tiny they can be seen only with a microscope. And feeding on them are tiny animals, most of them too microscopic in size. This mass of plants and animals makes a nourishing "soup" for the razor clams and many other burrowing animals who come to the victory dinner.

(All burrowing animals enter. Raccoon enters.) Suddenly all is not well. The sand crunches, startling the animals. It's a raccoon. The mighty foot has jerked the clam beyond the raccoon's rapidly digging paw. Safe for now but wait. Here comes Rodney (Boy enters) with his clam rake. This is one race Reesie must win or she'll be dinner for Rodney tonight.

Rodney: I'm leaving without a single razor clam, but with a few hundred mosquitoes after me. I know the easiest way to kill mosquitoes is to spray with chemical poisons such as DDT, BHC and Dieldrin. These chemicals are sprayed from the safety of an airplane (airplane enters), because the pesticides that kill mosquitoes can kill humans too. It can also kill many other animals, including crabs and worms.

Airplane: I'll fly back and forth spraying the poison in a fine mist over the water.

Narrator:
Within a few hours of the spraying thousands of mosquitoes are dead as well as many crabs, fish and other animals. Their bodies litter the shore between the tides. (Shorebirds enter.) Gulls and other shorebirds swoop down to an easy meal. (Mud snails enter.) And later, mud snails clean up the leftovers. But. the birds and snails are also eating poison. It would take a lot to kill them but the poison is stored in their bodies. It may cause trouble later.

The mosquitoes are one story. The animals between the tides are another. For them, the poison works all too well. It kills some quickly, others more slowly. And long after mosquito spraying is stopped, the pesticides go on killing. They are slow to break down and disappear.

By now no one can see the poisons. It sinks down through the water and settles on the bottom. It becomes an invisible part of the sand. It is taken up by the tiny plants and animals that float in the sea.

When the plants and small animals die, the poison still does not disappear. For as the dead beings decay and become food for small burrowing animals, the poison is passed on.

When a sea worm feeds on decaying bits of plant, it takes in the poison. Its body cannot cast out the poison, so the poison remains. And when a fish eats the worm, it swallows the poison too.

Soon there is far more poison in the fish's body than there was in the worm. For a young fish may eat hundreds of worms. There may be ten times as much poison in the body of the fish as there was in the plants.

There may come a time when there are not tracks between the tides. Lets look at a happier ending. (All burrowing animals sing: Beach Clam Dig – see page 17.)

The story need not end so badly. For people are beginning to understand that for our survival we depend as much on the mosquito or the worm that we don't eat as upon the fish that we do. The wisest scientists are leaning they can work with the natural world rather than against it.

Scientists are finding ways of controlling pests, such as beetles and caterpillars, weeds and disease, without poison.

In Florida and other states, scientists are using fish to control the mosquito population. They stock creeks and marshes with killifish and other minnows that eat wrigglers, or young mosquitoes. Both killifish and wrigglers in turn provide food for the young of the many ocean-dwelling fishes that develop in shallow water.

Man can change his own behavior by quite simple means. To drive away mosquitoes, for example, we can plant basil in pots near our doors and window. This herb has an odor that

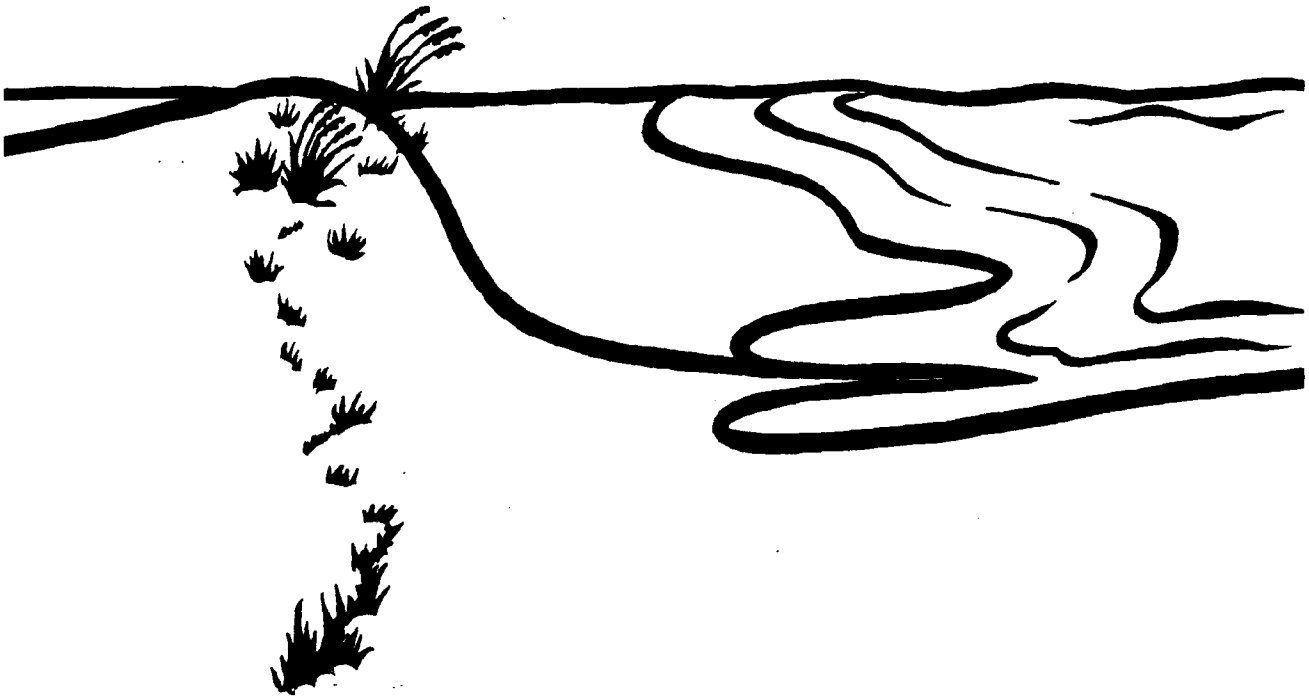
mosquitoes do not like. They do no like the smell of garlic or bananas either. By eating such food we can escape many bites. And if mosquitoes are too pesky to avoid, we can go swimming instead of digging. It may even make sense to stay home and mend the screens!

Of course looking for the right controls for each pest takes time and effort. Sometimes changing our behavior seems impossible and, for the sake of a worm or even a bird, an unnecessary bother.

Yet we too are part of the delicate web of seashore life even if we never eat a fish or oyster. What we do affects all life, as scientists have discovered. When we let our wastes poison the sea, we endanger our own survival too.

With this in mind as we track the animals between the tides, we may see them differently. And that may be a start toward a happy ending.

Adapted from: Shepard, Elizabeth. 1972. *Tracks between the Tides.* Lothrop, Lee and Shepard Co., N.Y., N.Y. 95 PP. (Recommended for elementary school libraries.)



"Beach Clam Dig"

Tune: Frere Jacques (Are you sleeping?)

Are you digging?
Are you digging?
Digging down
Digging down
Like the worms and clams do.
When the tide is changing
Dig, dig down
Dig, dig down

Snap! Goes The Worm's Tail

Tune: Pop! Goes the Weasel

Gull and pipers
Walking the beach.
Looking for a mole crab
Looking for a wiggly worm
Snap! Goes the worms tail.

SUGGESTED READINGS

1. "Why the Mosquito May be Winning the War", by Thomas A. Lewis, Photographs by Dwight R. Kuhn, National Wildlife, June - July 1986

2. "Perdido Key Beach Mouse Return", by Henry Cabbage, *Florida Wildlife*, July - August 1988

3. "Praising the Blues", by Frank Meyer, *Florida Wildlife*, July - August 1986

4. "Delicate Balance", Species: American Oystercatcher, by Susan Cerulean, *Florida Wildlife*, July - August 1986

5. "Delicate Balance", Species: Least Tern, by Brian Loland, *Florida Wildlife*, Sept. - Oct. 1986

6. "The Nation Tries to Unfold Its' Nest", by Susan Q. Stranahan, *National Wildlife*, April - May 1986

7. "Troubling Times with Toxics", 17th Environmental Quality Index, *National Wildlife*, February - March 1986

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Nybakken, James W. 1982. Marine Biology: An Ecological Approach. Harper and Row Inc. N.Y., N.Y. 440 PP.

Shepard, Elizabeth. 1972. Tracks between the Tides. Lothrop, Lee and Shepard Co. N.Y., N.Y. 95 PP